

AUTOMOTIVE PRODUCTION NUMBER—NOVEMBER, 1956

MACHINERY



**America's best-known bearing
keeps machinery on the go**

THE TIMKEN ROLLER BEARING COMPANY, CANTON 6, OHIO

AUTOMATION SIMPLIFIED

Two-Station Automated Multi-Unit
Bore-Matic precision finishes
8 different surfaces
at 140 parts per hour

The versatility of Heald Borizing, and the ability to perform several different operations simultaneously at a single station can contribute to the simplicity and economy of an automated production line.

The Multi-Unit Bore-Matic shown here, for example, can do in just two work stations what might otherwise have required more machines and a more extensive workhandling system. In this simple setup, cast iron pump covers are bored, turned, faced, grooved and chamfered at 140 parts per hour at 75% efficiency. Two parts are Borized simultaneously at each station and all operations except initial loading and final unloading are fully automatic.

For Automation that pays its own way...

IT PAYS TO COME TO HEALD

Left-Hand Head:

Bore Two Diameters, Generate Bottom Face, Groove and Chamfer with Cross-Feed Unit

STATION NO. 2

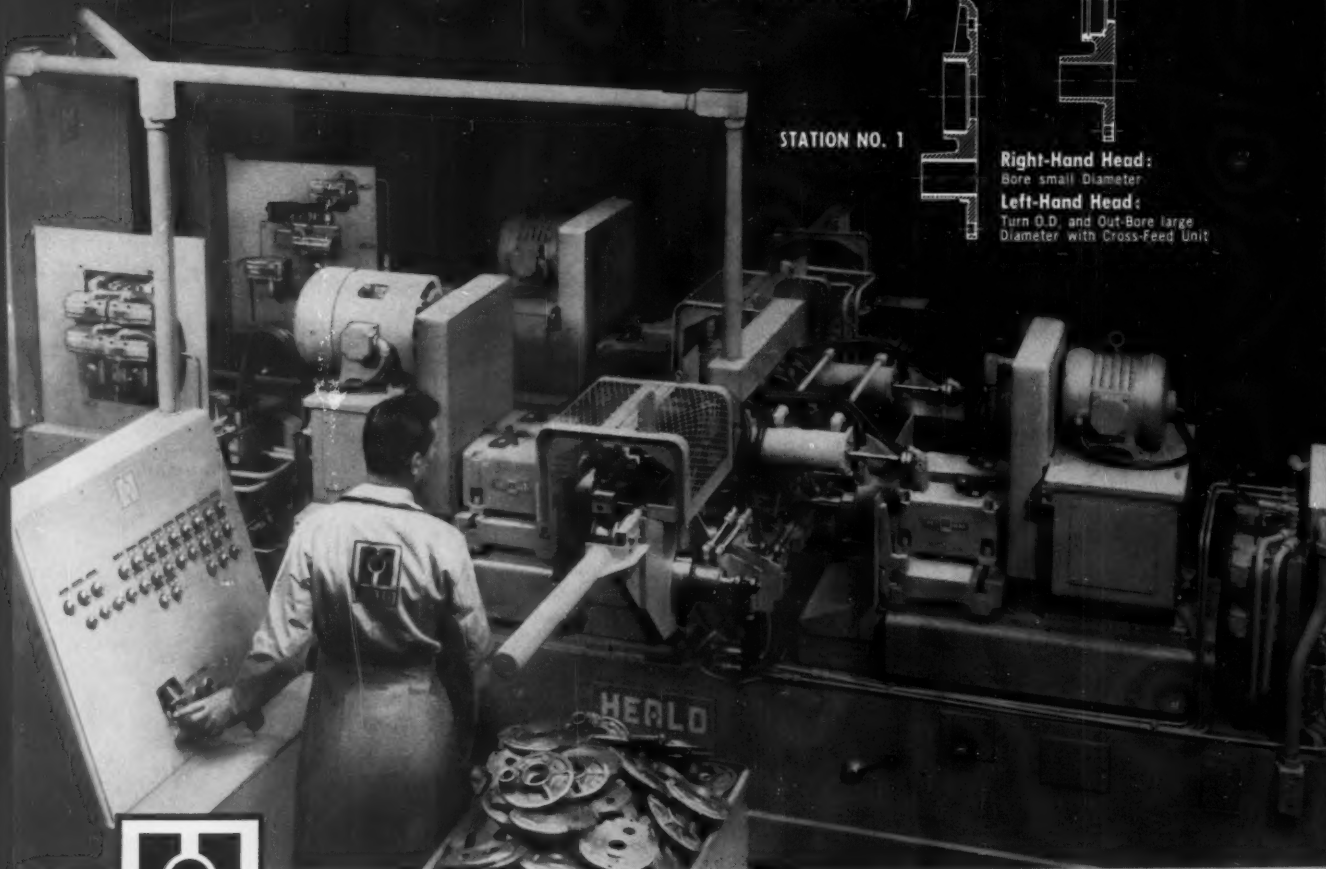
STATION NO. 1

Right-Hand Head:

Bore small Diameter

Left-Hand Head:

Turn O.D. and Out-Bore large Diameter with Cross-Feed Unit



THE HEALD MACHINE COMPANY

Subsidiary of The Cincinnati Milling Machine Co.

Worcester 6,
Massachusetts

Chicago • Cleveland • Dayton • Detroit • Indianapolis • New York

MACHINERY

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MACHINERY

VOLUME 63

NOVEMBER, 1956

NUMBER 3

The Monthly Magazine of Engineering and Production
in the Manufacture of Metal Products

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THREAD ROLLING

Field installations of the new LANHYROL Thread Rolling Machine are producing outstanding results. Production data from representative jobs, shown on the opposite page, indicate the unequalled output, flexibility, and range coverage of this revolutionary new machine, not available anywhere else in the Western Hemisphere.

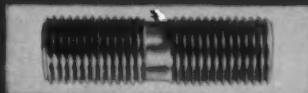
The LANHYROL Thread Rolling Machine produces strong, accurate threads of excellent finish by the chipless, cold-forming process using four different Rolling Methods—Thrufeed, Infeed, Continuous, and Reciprocal. It will thread all diameters from $\frac{3}{16}$ " to 3", producing left- and right-hand threads of all types (except square), including UNC, UNF, Acme, worm, and many special forms.

Additional information on request—please send specifications and ask for Bulletin E-60.

467C

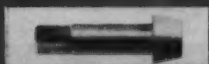
WORKPIECE: Jack Screw

MATERIAL: C1018 Steel
THREAD SPECIFICATIONS: 1"-8 pitch
28° Acme
TOLERANCE: Class 4C
METHOD: Threaded Rolling
PRODUCTION: 30" per minute (rolled in 36" lengths—can be rolled in 12" lengths)



WORKPIECE: Double-End Stud

MATERIAL: C1040 and SAE 0620 Steel
THREAD SPECIFICATIONS: 2"-4 1/2 pitch
28° Acme
TOLERANCE: Class 3
METHOD: Infeed Rolling (manual loading)
PRODUCTION: 1 1/2 min. rolling time per piece (both ends)

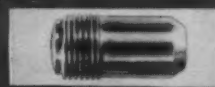


WORKPIECE: Aircraft Bolt

MATERIAL: 4340 Steel of 36-40 Rockwell C
THREAD SPECIFICATIONS: 1"-14 pitch
NE—1-5/16" thread length
TOLERANCE: Class 3A (Military Spec. MIL-B-7828-A)
METHOD: Infeed Rolling (manual loading)
PRODUCTION: 10 pieces per minute

WORKPIECE: Timer Switch Leadscrew

MATERIAL: 81112 and C1112 Steel
THREAD SPECIFICATIONS: 1/4"-16 Pitch
Standard Acme
TOLERANCE: Class 3G
METHOD: Threaded Rolling
PRODUCTION: 48" per minute (rolled in 18" lengths—can be rolled in 12" lengths)



WORKPIECE: Barrel—MG Gun Perforator

MATERIAL: 60 Carb. Silicon Tool Steel
THREAD SPECIFICATIONS: 1 1/4"-6 pitch
28° Acme—1" thread length
TOLERANCE: Class 3G
METHOD: Infeed Rolling (hand-operated work-holding fixture)
PRODUCTION: 15 pieces per minute



WORKPIECE: Transfer Drive Worm

MATERIAL: Stainless Steel
THREAD SPECIFICATIONS: 1/4"-26 diametral pitch, left-hand, single—1 1/4" thread length
TOLERANCE: 1825—1805 P.D.
METHOD: Infeed Rolling (manual loading)
PRODUCTION: 20 pieces per minute

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Machine
COMPANY

WAYNESBORO • PENNSYLVANIA • U. S. A.

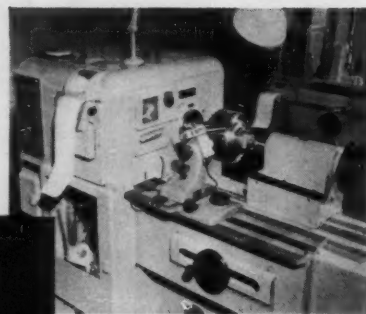


"PUTTING TEETH" IN



Fellows 36-Type Gear Shapers at Philadelphia Gear Works: powerful, accurate and fast on long runs or special jobs.

CUTTING INSPECTION



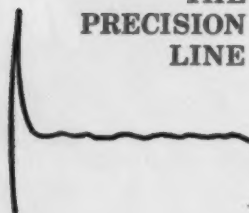
Fellows No. 12H Lead Measuring Instrument checks lead, crown and taper and electronically provides charts of results for Philadelphia Gear.



Fellows No. 20M Red Liner automatically records all gear errors in combination, giving Philadelphia Gear a composite check on quality.

Fellows No. 12M Involute Measuring Instrument at Philadelphia Gear is simple to set up, checks involute profiles, and records any departure from specifications.

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PRECISION
LINE



phillie gear[®] STANDARDS

Integrated Fellows Gear Shapers and Inspection Instruments Assure Close-Tolerance Production

Consistently high quality is maintained at Philadelphia Gear Works by fast and accurate Fellows Gear Shapers teamed with Fellows Inspection Instruments. Inspection and recording by Fellows Instruments gives accurate warning of production errors and their nature, provides visible proof of gear quality. 'Phillie Gear' relies on Fellows equipment for producing gears for their famous Speed Reducers as well as many other industrial spur or helical gears.

Integrated production and inspection with Fellows equipment assures unified responsibility for meeting standards and precise quality control at lowest possible costs.

Ask any Fellows Representative for full information about the complete line of Fellows Gear Shapers, Shaving Machines, and Gear Inspection Instruments.

THE FELLOWS GEAR SHAPER COMPANY

78 River Street, Springfield, Vermont

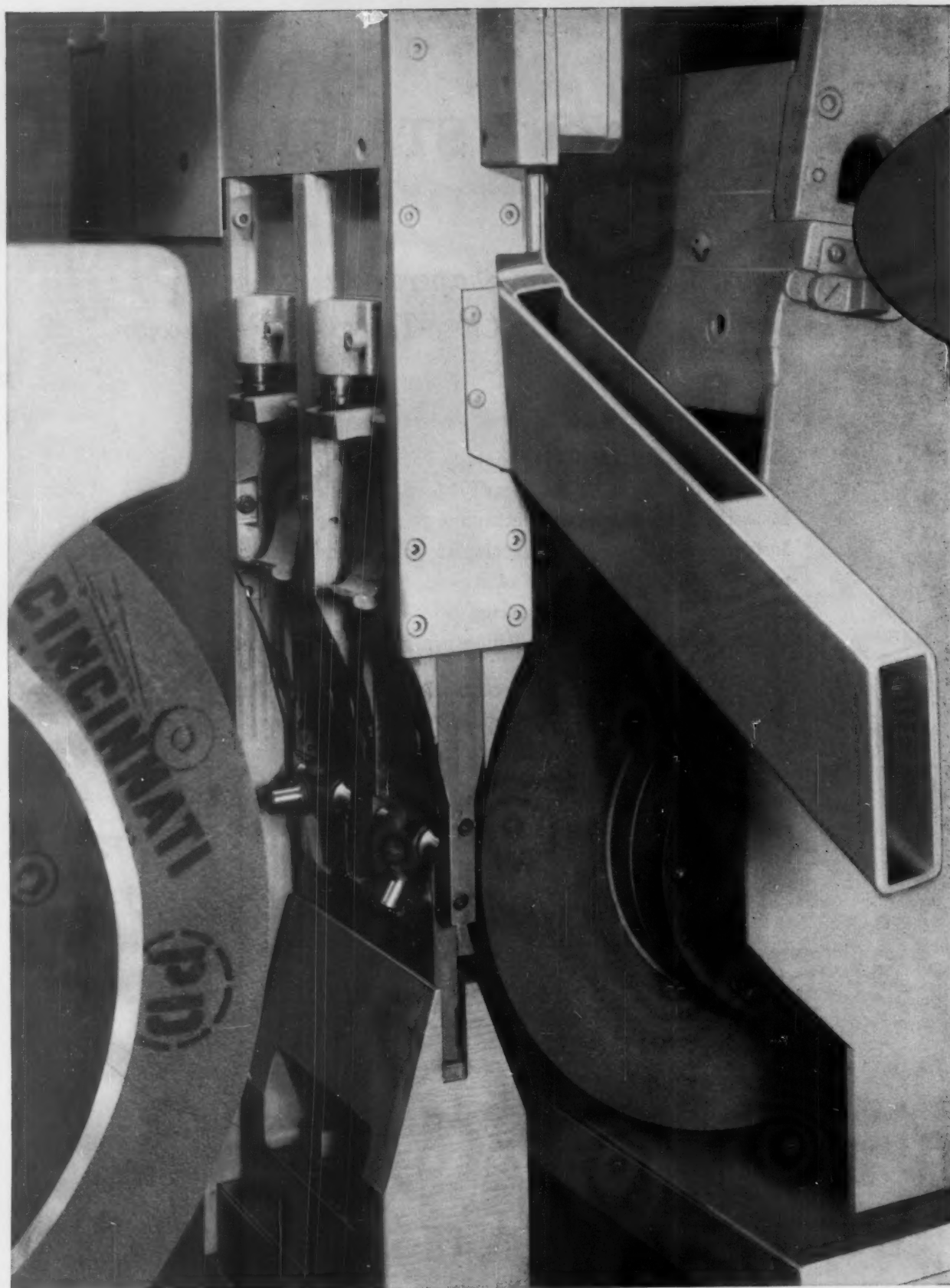
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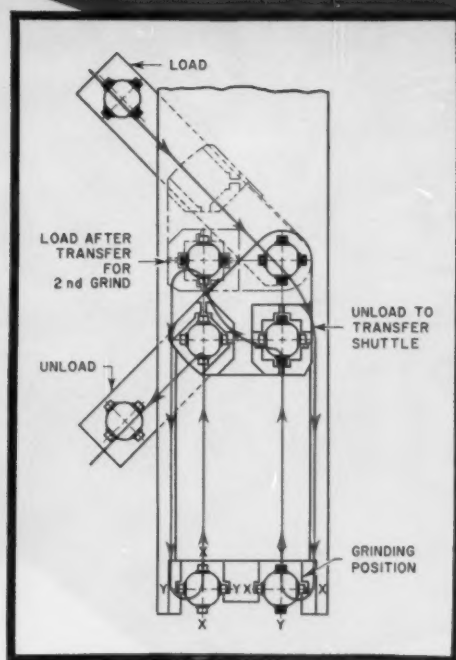
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Fellows Gear Production Equipment



Unique Transfer Idea Solved This Problem:

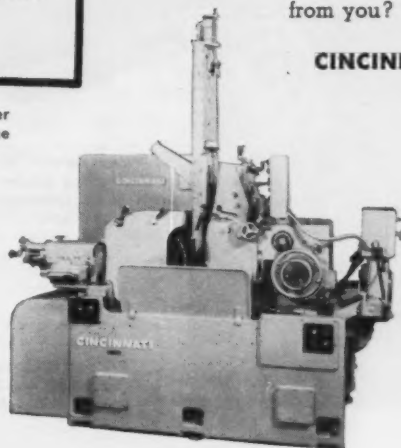
To Automatically Grind Four Diameters of Universal Joint Spiders in One Cycle



Schematic drawing of loading and transfer fixture. Parts are ground on axis X in one station, and axis Y in the other.

Everyone familiar with universal joint spiders will agree that it's a neat trick to automatically grind the two pin diameters on each of two parts at the same time. Cincinnati automation specialists devised a way to do the job on a new CINCINNATI® FILMATIC No. 2 Centerless Grinder. A unique transfer mechanism, incorporated in the loading fixture developed by Cincinnati for the machine, was the key to this low-cost method of production. Principle of operation is diagrammed at the left. ¶ The manufacture of universal joint spiders may not be your line of work, but some type of precision cylindrical grinding is required in your shop, and Cincinnati grinding and automation specialists can help you do a better job at lower cost. You can be sure that these men will give you the benefit of the most advanced thinking in centerless grinding methods, backed up by 33 years' experience. May we hear from you?

CINCINNATI GRINDERS INCORPORATED
CINCINNATI 9, OHIO



CINCINNATI FILMATIC No. 2 Centerless Grinder, equipped to automatically grind universal joint spiders. You will find brief information on the standard No. 2 machine in Sweet's Machine Tool File. For complete data, write for catalog No. G-644-1.

Two universal joint spiders are in process at the same time, grinding two pin diameters on each of two parts. Estimated production, 300 completed parts per hour.

CINCINNATI

CENTERTYPE GRINDING MACHINES • CENTERLESS GRINDING MACHINES • ROLL GRINDING MACHINES • SURFACE GRINDING MACHINES • CHUCKING GRINDERS • MICRO-CENTRIC GRINDING MACHINES • CENTERLESS LAPPING MACHINES

For more information fill in page number on Inquiry Card, on page 273

MACHINERY, November, 1956—7

VAN NORMAN



Van Norman "Bowgag" 4BG2 double head plunge cut chucking grinder. Capacity: 6" swing double work head. Grinding wheel: 30" x (3/4 to 6) x (12 or 20). Grinding wheel motor: 10 to 20 H.P.

Grinding Universal joint flange on the Van Norman "Bowgag" 4BG2 — .022 stock removal — 1.625 diam. — 15 R.M.S. — Maximum 480 pieces per hour.

VAN NORMAN MACHINE

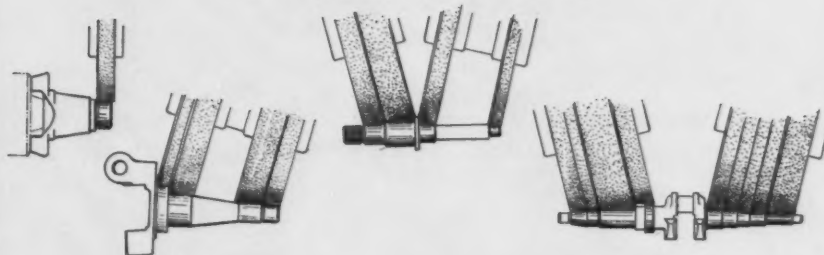
MANUFACTURERS OF — Ram and Column Type Milling Machines, Cylindrical Grinders, Spline and Gear Grinders, Oscillating Radius Grinders, Special Production Grinders, Centerless Grinders.

"BOWGAGE" PRODUCTION GRINDERS

"Engineered for the Job"

**Outperform Them All For
Speed, Accuracy and Low Cost Grinding**

*Sketches illustrate actual grinding applications performed
for users of single and double head plunge cut
special purpose grinding machines.*



You just can't beat Van Norman "Bowgage" Production Grinders for fast, economical mass production. These massive, rugged grinders are "*engineered for the job*" to meet your exacting requirements.

Illustrated is the Van Norman "Bowgage" 4BG2 double head plunge cut grinder designed and built for a major

automotive manufacturer. Day after day, this 14.8 ton rugged brute and other single and double head grinders are showing substantial savings by keeping production up and costs down.

If you have a mass production grinding problem, let Van Norman Engineers help you solve it. Write for their help, today.

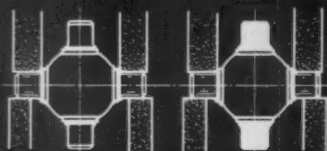
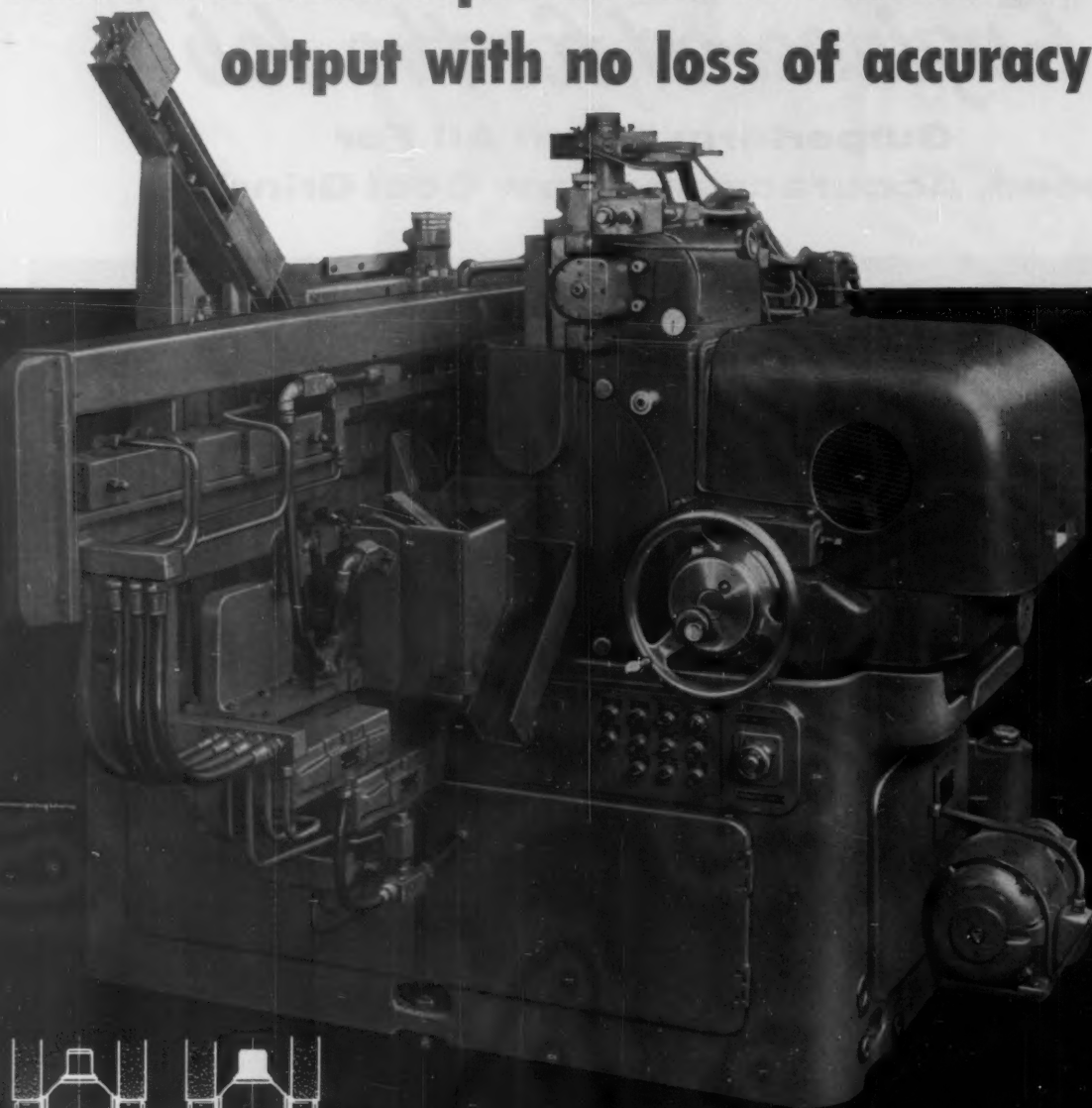
*Don't wait . . . for extra profits install a Van Norman Machine now!
They are available on many purchase plans — Outright sale . . . Purchase on conditional
sales contract up to five years . . . Pay as you depreciate . . . See your dealer
or write Van Norman Company.

Conditional Sales Contracts not available to Export.

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**SPRINGFIELD 7,
MASSACHUSETTS**

**Landis ideas on automatic operation
raise centerless production...increase
output with no loss of accuracy**



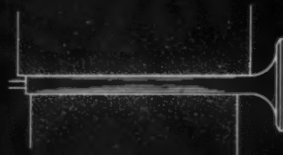
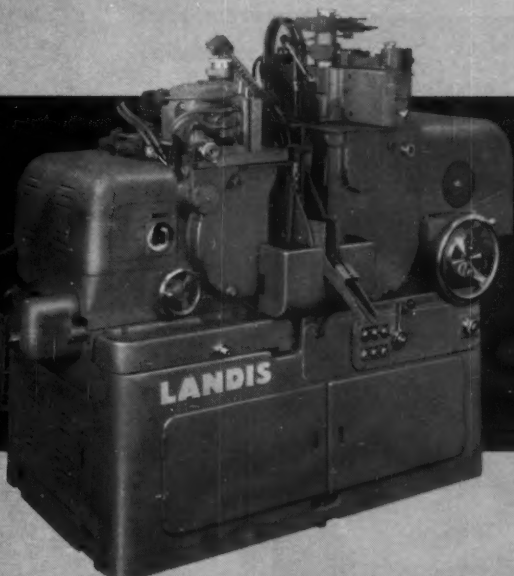
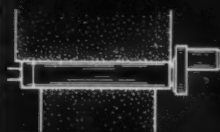
**Automatic Grinding of Four Diameters and radii of universal
joint spiders in one loading. Production is 250 per hour.**

LANDIS
precision grinders



Automatic Grinders in Tandem for 3-operation grinding of motor shafts.

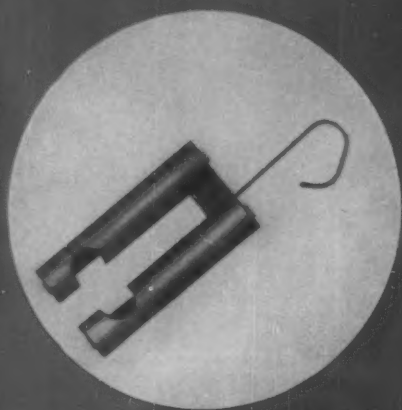
Automatic Grinding of Small Crankshaft. Production is 375 pieces per hour.



Automatic Finish Grinding of 1320 automotive valves per hour.

LANDIS TOOL COMPANY

WAYNESBORO, PENNSYLVANIA

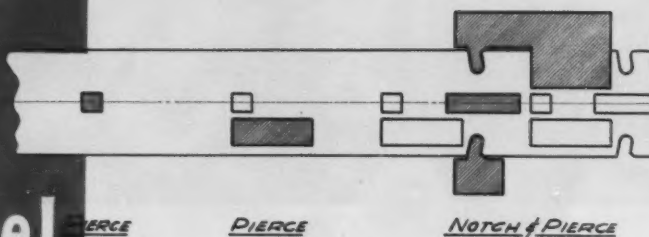


Produced Complete!

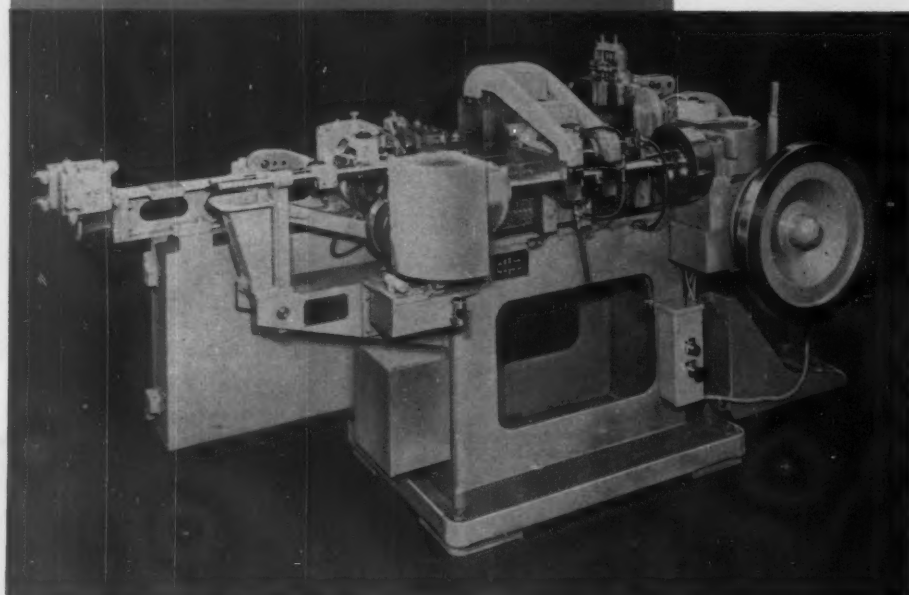
**No Secondary
Operations!**

on the

U. S. MULTI-SLIDE®

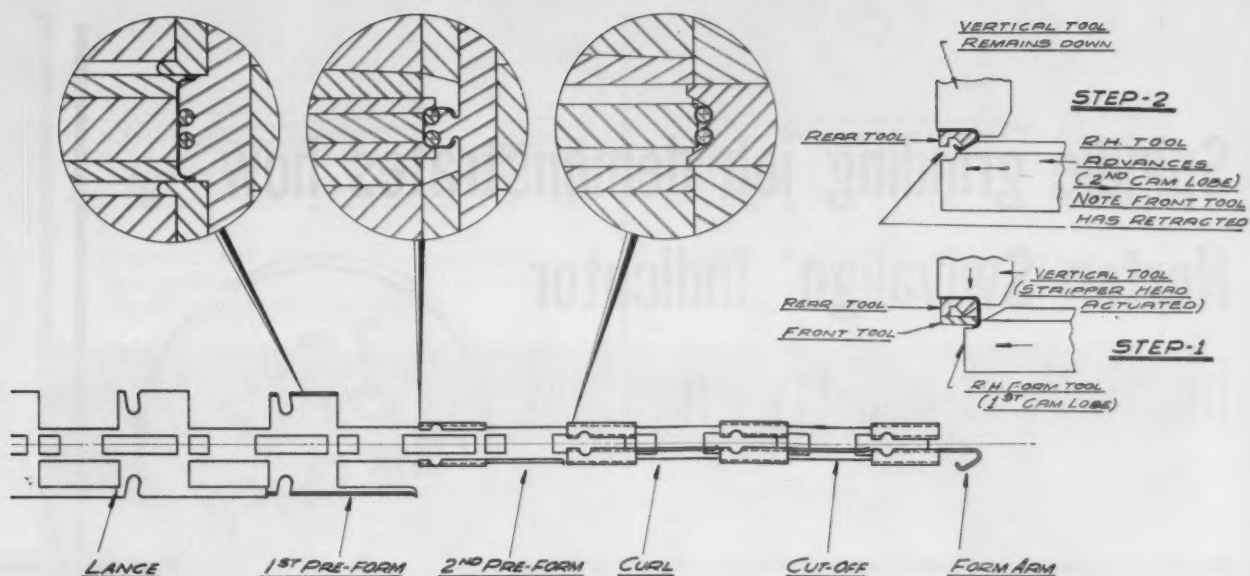


The drawings above indicate the sequence of operations in the dies and forming position to complete the intricately formed metal stamping shown to the left above (four times actual size).



#28 U. S. Multi-Slide Machine used with appropriate tooling to produce the part shown above.

U. S.



The intricately formed metal stamping (shown four times actual size on the opposite page), is just one of the many different types of stampings which can be produced without secondary handlings on the U. S. Multi-Slide.

Eliminate secondary operations—reduce costs—increase production: You, like all manufacturers, are interested in achieving these results. In the pressroom this may be accomplished through the use of the U. S. Multi-Slide Machine. Standard machine equipment includes ram action, four slide forming position and vertical stripper movement. These various movements make the U. S. Multi-Slide a versatile machine and allow for the production of complicated formed metal stampings without secondary handlings.

Ask for a copy of Bulletin No. 15-M which illustrates and describes these machines and contains the specifications for the four sizes now being built.

TOOL COMPANY, Inc.

AMPERE (East Orange)

NEW JERSEY

Builders of U. S. Multi-Slides — U. S. Multi-Millers

U. S. Automatic Press Room Equipment — U. S. Die Sets and Accessories

For more information fill in page number on Inquiry Card, on page 275

MACHINERY, November, 1956—13

Spindle grinding job demonstrates how Norton Swivalign* Indicator beats "cut-and-try" method



THE JOB Finish grinding bearings and tapers on grinding wheel spindles.

THE PROBLEM Reduce grinding time and costs.

THE SOLUTION: The use of Norton's SWIVALIGN dual-electric indicator to measure swivel table adjustment in setting up the grinder.

Here is another Norton forward step in the teamwork between man and machine.

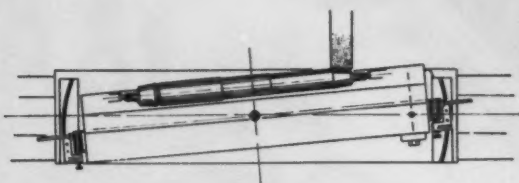
The man sets the indicator . . . the SWIVALIGN device permits him to put the work in line more accurately than the human eye could see.

There were two savings here: First, the tedious time consuming work of the cut-and-try method was eliminated entirely; second, the grinding time for this job was reduced a full 15%. It's just another demonstration of the *every-time* cut in hours and work by use of

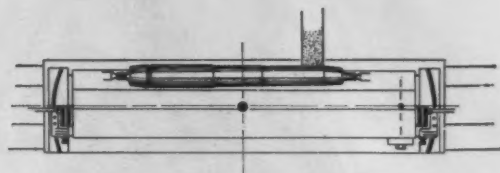
the Norton SWIVALIGN Indicator.

FOR INFORMATION on the Norton SWIVALIGN Indicator and on its application to Norton universal and cylindrical grinders, see your Norton Representative, or write direct. And remember, only Norton offers you such long experience in both grinding machines and wheels to bring you the "Touch of Gold" that helps you produce more at lower cost. **NORTON COMPANY, Machine Division, Worcester 6, Mass. In Canada: J. H. Ryder Machinery Company, Ltd., Toronto 5.**

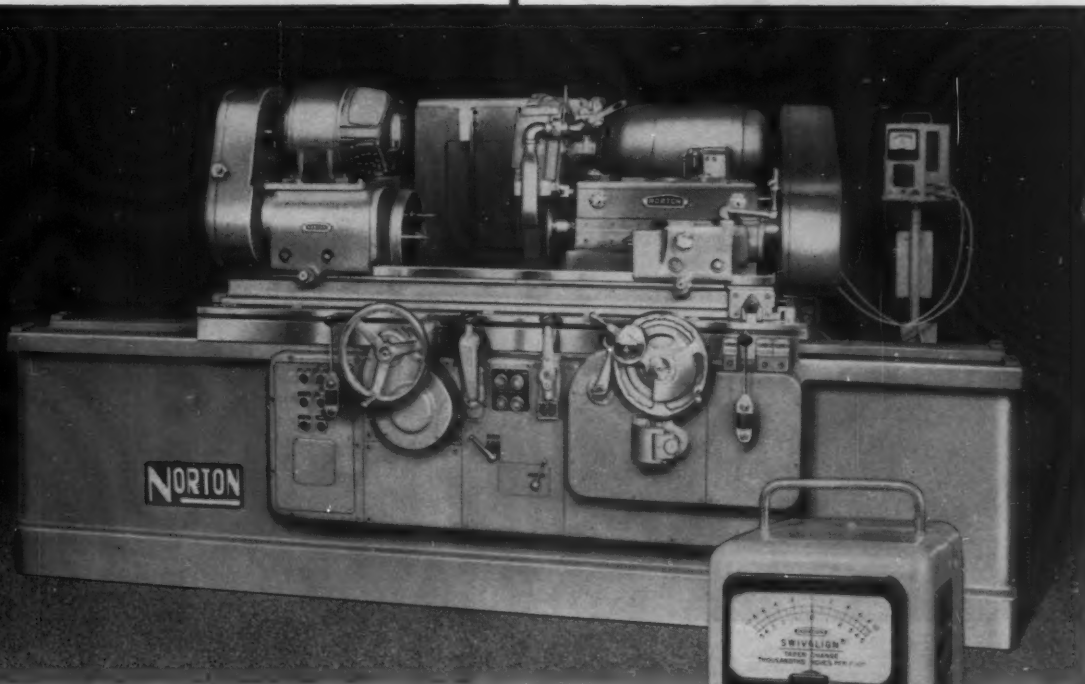
*Trade-Mark



GRINDING SPINDLE TAPER ENDS went more quickly and cost less when a Norton SWIVALIGN device was used to set the table at the correct angle to grind.



BEARING DIAMETERS of the spindle quickly moved into correct position for grinding . . . SWIVALIGN unit proved vastly superior to old "cut-and-try" method.



▲ **SWIVALIGN DUAL ELECTRIC INDICATOR** on TYPE CTU cylindrical grinder was used to demonstrate savings on spindle finish grinding. The SWIVALIGN Indicator is also available on Norton universal grinders.

A NORTON "TOUCH OF GOLD" development for faster, better, lower-cost grinding is the SWIVALIGN Indicator. It enables the operator to adjust the angular positions of swivel tables quickly and accurately. Positive response and easy operation are features.



To Economize, Modernize with NEW



GRINDERS and LAPPERS

*Making better products...
to make your products better*

District Offices: Worcester • Hartford
Cleveland • Chicago • Detroit
NORTON PRODUCTS: Abrasives • Grinding
Wheels • Grinding Machines • Refractories
BEHR-MANNING PRODUCTS: Coated Abrasives
Sharpening Stones • Behr-cat Tapes



FOR A PRODUCTION BONUS—

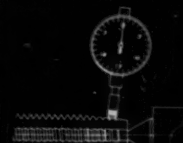
BALANCED ACTION

There are many mechanical and technical superiorities in the design and manufacture of Winter Balanced Action Taps. These give you a production bonus in size control and in prolonged tool life.

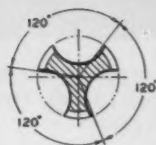
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EXACT FLUTE SPACING



UNIFORM
FLUTE CONTOURS



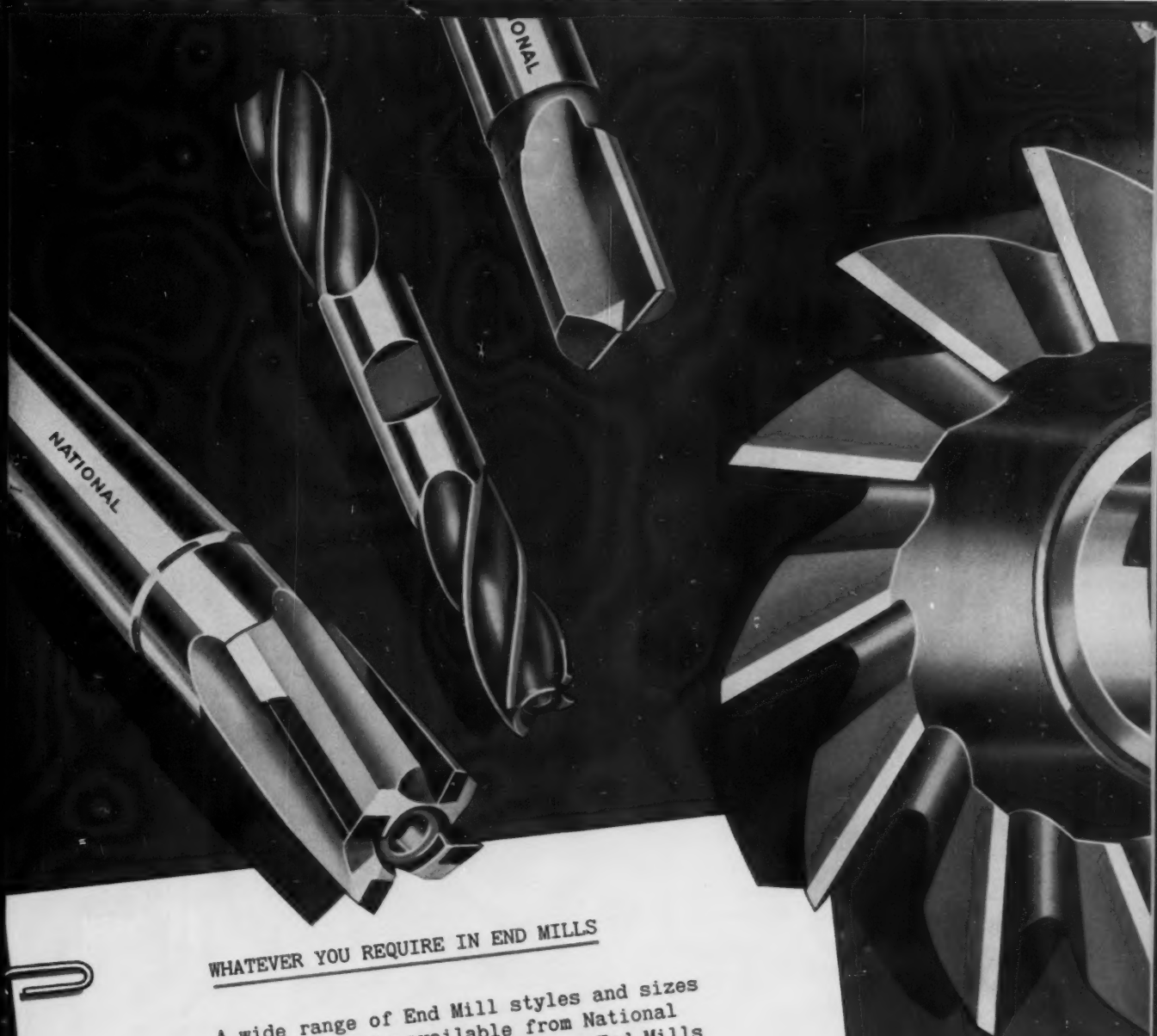
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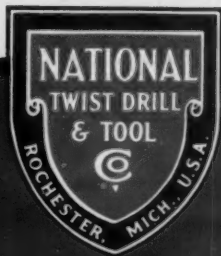
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A wide range of End Mill styles and sizes are immediately available from National stocks. We also design and make End Mills for many special applications. When applications call for laboratory research, write our Engineering Department.

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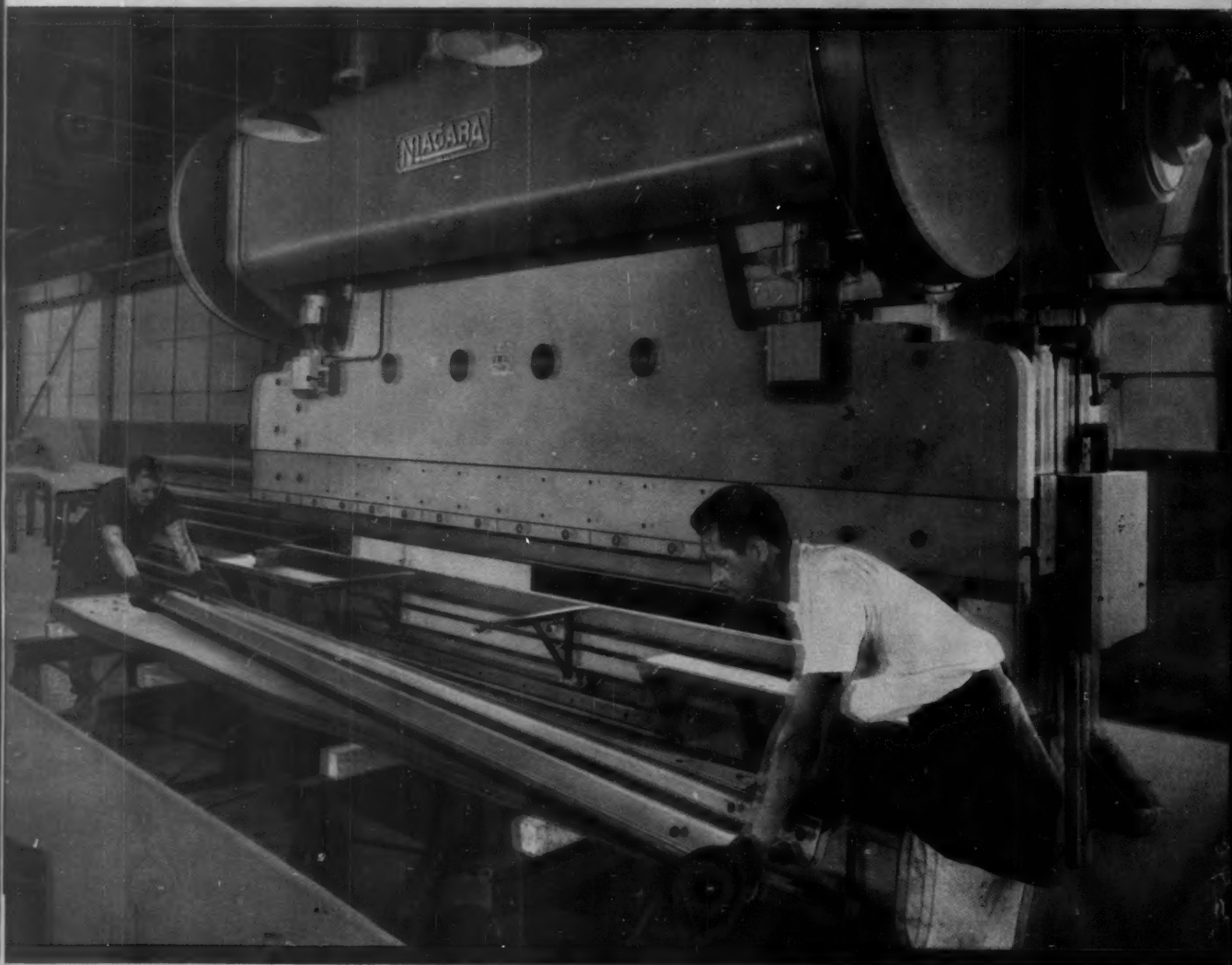
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SPECIAL TOOLS



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DISTRIBUTOR



"we go back to



(Above) Forming highway guard rails from 12 gage steel on Niagara 520 Ton Press Brake.

(Right) Piercing rails with same machine.

(Far Right) Forming chair seat frames for office furniture from 20 gage steel on Niagara 150 Ton Press Brake.

Niagara for Press Brakes"

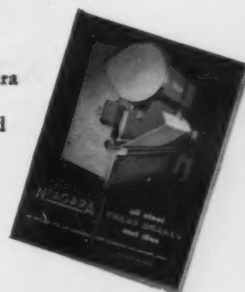
"The personnel of our organization has been acquainted with Niagara equipment for years. Niagara will stand behind *any* equipment furnished. Many millions of operations in the past 5 years on their presses and press brakes... equipment satisfactory from both the operational and safety standpoint. Our intention is to use the Niagara line entirely."

There in the words of one customer (a large Ohio metal fabricator whose press brake operations are illustrated), you have the sentiments of hundreds. Once experienced with *any* of the other metalworking machines which Niagara makes... presses, shears, bending rolls and dozens more... one just naturally thinks first of Niagara whenever the subject of press brakes comes up.

REASONS ARE MANIFOLD: (1) Extreme helpfulness of Niagara's engineers in selecting the machine and accessories that will do the job best (no other manufacturer can offer so complete and large a line of sheet and plate metalworking equipment). (2) Unrivalled reputation and experience in the field, dating back 77 years, that assure unquestioned reliability. (3) World-wide recognition for design leadership, combining rock-bottom operating economy and top-notch performance in *every* product it makes (take a moment to run down this partial list of imposing press brake features):

- *Double end twin drive with double reduction gearing for smooth, uniform application of power at both ends of ram.*
- *Rugged, all-steel frames with box type crowns of unequalled strength and rigidity.*
- *Extra heavy, rigid bed and ram for maximum support of dies.*
- *Gearing totally enclosed in sealed oil baths for thorough, clean lubrication.*
- *Longer lasting, laminated, nonmetallic ways.*
- *Powerful, smooth-acting, multiple disc clutch and brake.*
- *Gibs maintain accurate, endwise alignment of ram.*

Standardized in a complete line, ranging from 50 through 775-ton capacities, Niagara Press Brakes are built to produce a tremendous variety of work uniformly and accurately. Post yourself now on all the details by requesting Bulletin 89 D and, as soon as you can, avail yourself of some really worthwhile suggestions from a Niagara representative. Write.



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America's most complete line of presses, press brakes, shears, other machines and tools for plate and sheet metal work



NIAGARA PRESS BRAKES

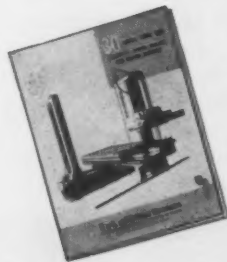
UNSURPASSED versatility...

Giddings & Lewis 30-Series Horizontal Boring, Drilling and Milling machines assure extra rigidity, maximum capacity, precision performance for a broad range of applications

UNUSUAL WIDE RANGE of precision machining operations—that's what you get when Giddings & Lewis 30-Series horizontal machines start to work in your shop. These highly versatile (table type) horizontals offer you more combinations of profitable machining operations than any other machine in this size ever built!

Available in two models — 350-T with 5" dia. spindle (25 hp) and the 340-T with 4" dia. spindle (20 hp)—they feature rugged design and capacity-boosting optional attachments. Included are: angular milling attachments, continuous feed facing head, automatic electric-operating positioning device for headstock and table travel, *Dupli-TRACER* for 2- or 3-dimensional contour tracing and 360° profiling, G&L's exclusive "Lubri-Cool" system for headstock and milling feed unit, and many other time-saving, profit-making arrangements.

For more information, be sure to contact your nearest Giddings & Lewis representative today!



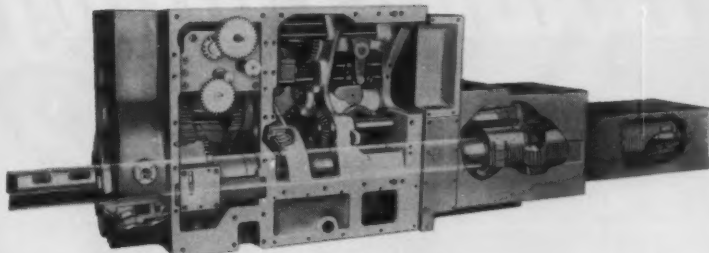
Literature Available:

For complete specifications on G&L 30-Series (table-type) Horizontal Boring, Drilling and Milling machines, ask for Bulletin No. 30-T.



UNLIMITED

productivity

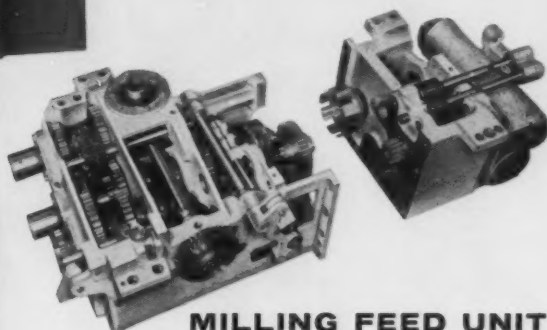


HEAVY-DUTY HEADSTOCK

Rapid-Change Feeds and Speeds — G&L headstock offers the ultimate in precision workmanship. Superb design assures smooth, vibrationless operation and is the key to high productive capacity. Positive gear drive permits high torque at lower speeds and full horsepower at higher speeds. You get 36 independent feeds to the spindle . . . a minimum of 45 workable spindle speeds.

Operator can use either the conveniently located lever or push button control for sensitive inching and tapping operations.

Rotary Selectors — Dial openings show spindle speed or feed engaged. Operator merely watches window until desired setting is obtained. *There's no need for matching of levers with charts.*



MILLING FEED UNIT

Greater Milling Capacity — G&L 30-Series Horizontals are particularly adaptable to a broad range of milling operations such as milling angular outlines at high rates of speed. A nine-speed box and a set of back-gears provide eighteen milling feeds for the headstock, table and saddle; selective clutches for feed and rapid traverse; planetary reduction for two distinct ranges for the saddle feed.



G & L and HYPRO DIVISION
GIDDINGS & LEWIS MACHINE TOOL CO.
FOND DU LAC, WISCONSIN

Builders of the world's finest heavy-duty Horizontal Boring, Drilling and Milling Machines — table, floor and planer types; HYPRO Double Housing and Open-side Planers; Planer-Type Milling Machines; Vertical Boring Machines; Spar and Skin Milling Machines, and VARIAX Milling Machines.

G-47

For more information fill in page number on Inquiry Card, on page 275

MACHINERY, November, 1956—21

**cuts going
cuts coming...that's**
Double-Cutting

No idle return stroke—cuts both ways. That's why this new GRAY UNIVERSAL PLANER is the most productive planer ever built. Instantaneous change-over from standard to double cut planing. Simple standard carbide tooling.

GRAY is building a large number of these new planers for customers who have recognized that a planer pays when it cuts. This Gray Universal single cuts, double cuts, triple cuts, cross cuts and substantially cuts your set-up and handling time.

The G. A. GRAY Co., Cincinnati, Ohio



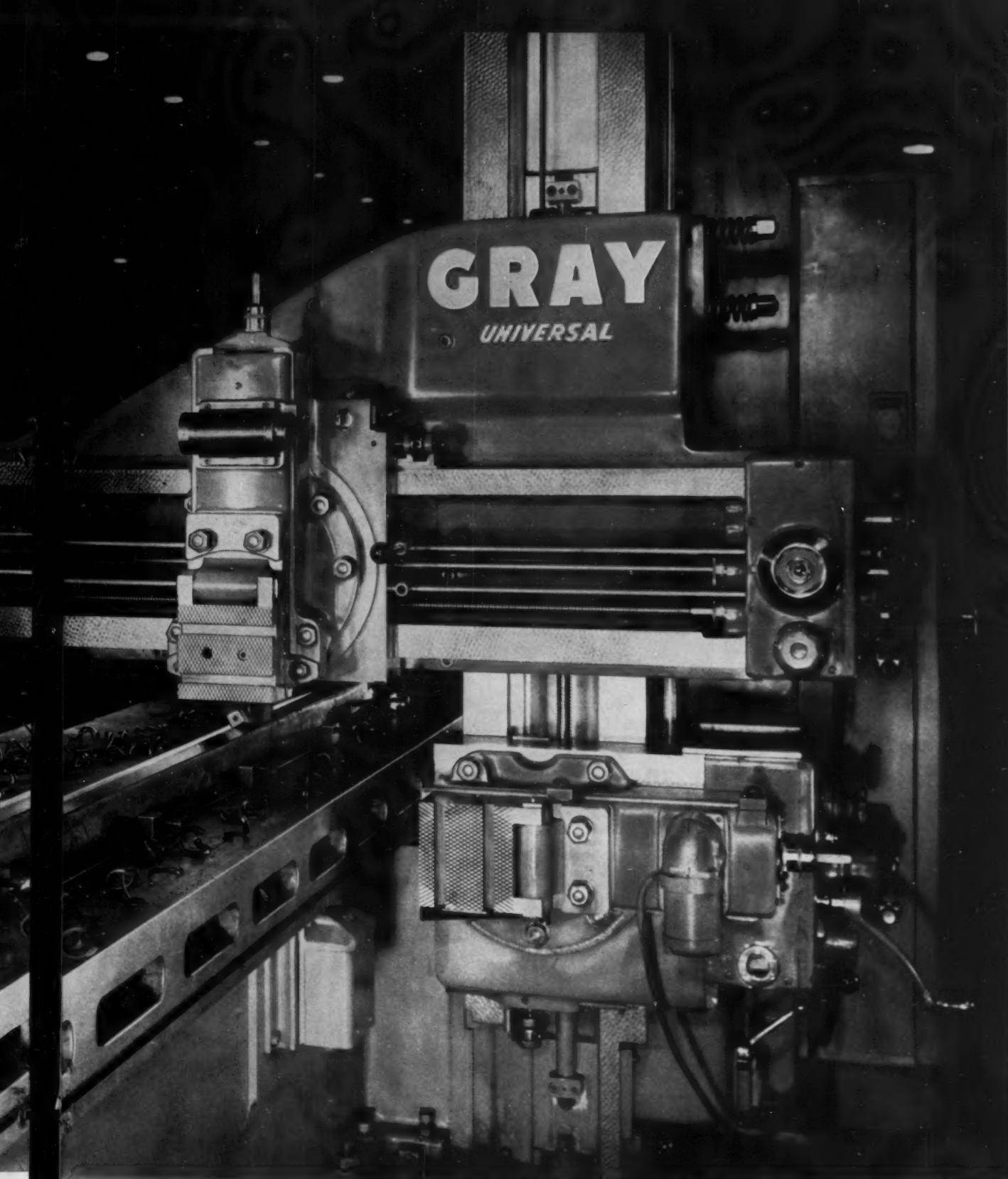
heavy-duty planing

The Gray Universal is the world's most powerful planer available for conventional planing. Its rigidity and speed are ideally suited for modern carbide cutting.



double cut planing

The flick of a lever, the touch of a button permits double cutting. Elimination of the idle stroke insures the world's most efficient flat surface machining. Only simple carbide tools are required.



triple cut planing

Rough and rough-finish plane at the same time. Rough by double cut planing and simultaneously rough-finish with a single point tool. Then finish plane without a tool change.

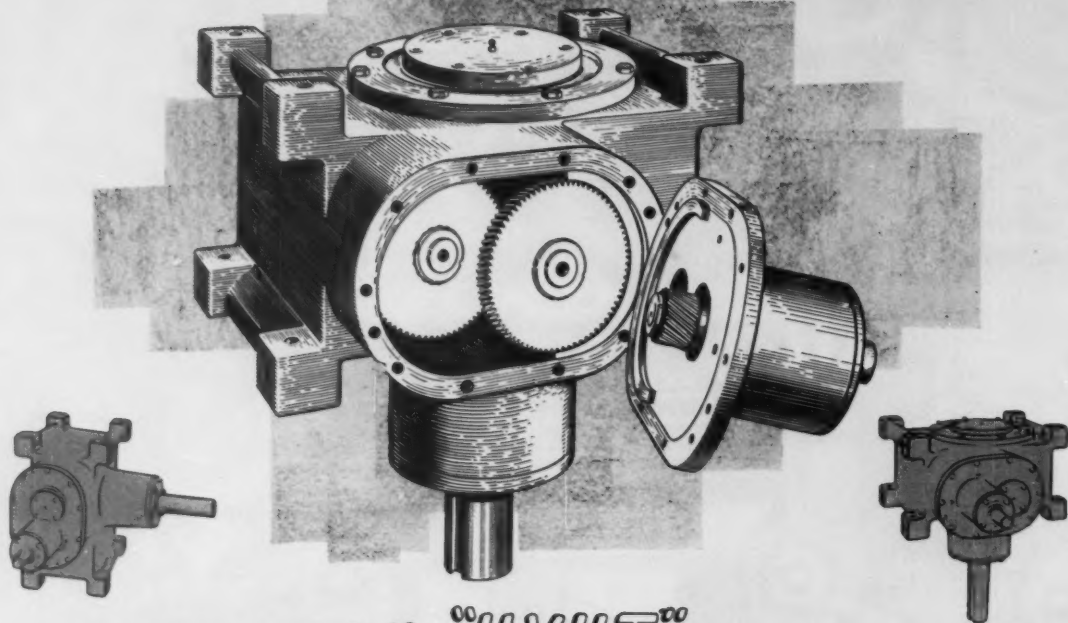


cross planing

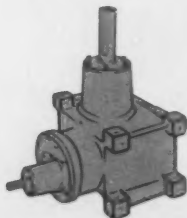
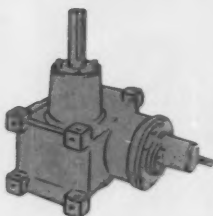
Eliminates extra settings by cross planing the occasional keyways, chamfered corners, and other troublesome small cross surfaces that formerly added hours to your set-up time.

***Now* - a truly Flexible Mounting**
UNIVERSAL CHANGE-SPEED

Conveyor Drive



you can mount the **"HVUT"**
in any of these positions



The Phillie Gear "HVUT" Speed Reducer was developed from many years' experience, especially for application to Conveyor Drives. It embodies all features for Flexible Mounting, plus wide range of output speeds, and the rugged durability so necessary for conveyor installations—yet all at a low initial cost.

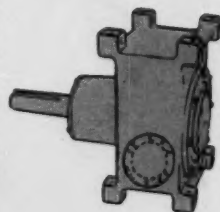
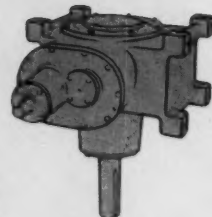
Particularly important to Conveyor Users, is the ease of changing the output speed—within a matter of minutes, the helical gear chamber may be opened and gearing replaced to alter the output speed. This versatile Reducer can be applied to most any type of Conveyor: floor, trolley, and pit—and it is also being used for other applications in industry, where unusual versatility is required.

The "HVUT" Unit may be mounted in any of the positions shown above, and when the shaft is mounted in a vertical down position, it is ideal for the overhead conveyors, which are so widely used in the automotive industry; also, the dust-proof housing makes it very desirable for pit type conveyors. When the output shaft is mounted in a vertical up position, the "HVUT" Reducer is excellent for Tow line Conveyors.

The Philadelphia Limitorque feature can also be furnished with these conveyor drives. The Limitorque device instantly breaks the motor circuit in the event of a conveyor jam or severe overload.

Gearing, bearings, and housing of the "HVUT" Unit is manufactured in strict accordance with AGMA Standards... Standard reduction ratios from 50:1 to 1800:1 in six unit sizes can normally be delivered promptly from stock.

Send for Booklet describing and illustrating unusually versatile Reducers.



See the newest developments in Mechanical Power Transmission at our Booth #80—22nd National Power Show, New Coliseum, New York City, November 26-30.

phillie gear[®]

PHILADELPHIA GEAR WORKS, INC.

ERIE AVE. & G STREET, PHILADELPHIA 34, PENNA.

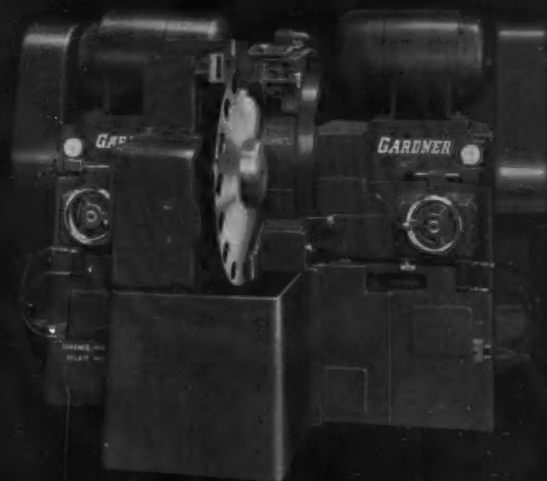
Offices in all Principal Cities

INDUSTRIAL GEARS & SPEED REDUCERS • LIMITORQUE VALVE CONTROLS • FLUID MIXERS • FLEXIBLE COUPLINGS

Virginia Gear & Machine Corp. • Lynchburg, Va.



Horizontal Disc Grinders—For grinding one surface at a time on cast, forged or fabricated parts with either freehand or fixtured operation.



Precision Double Spindle Grinders—Grinds TWO parallel surfaces in ONE operation. Rotary, thrufeed or gun type work fixturing.

for flat surface grinding
... low unit cost
... volume production

GARDNER

precision disc grinders
BELOIT, WISCONSIN

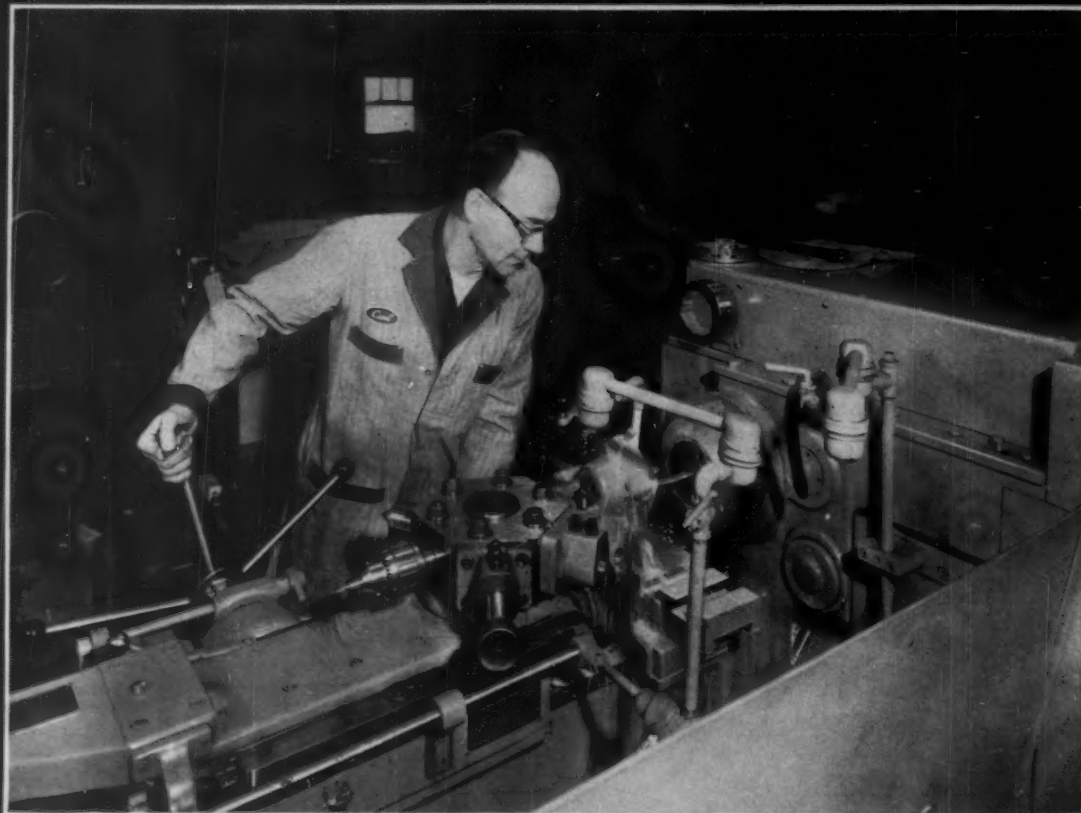
Single Spindle Grinders—For production grinding single surfaces. Manual and power-operated work-carrying fixtures available.



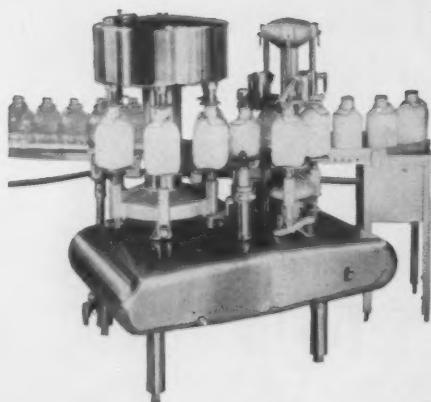
Special Purpose Disc Grinders—For sequence grinding, parallel surfaces, generating curved surfaces ... single or multiple surfaces in one setup.



NEW WARNER & SWASEY



New Warner & Swasey No. 4 Turret Lathe for machining stainless steel dairy equipment components (shown at right) at Federal Mfg. Co., Milwaukee, Wisc.



SPECIALIST PRODUCER of milk bottle filling and capping machines, Milwaukee's Federal Mfg. Co.—a small, but most progressive organization—is today enjoying a phenomenal growth. This is due to the dairy industry's enthusiastic acceptance of their new and unique 'Vacu-Matic' filling machines.

PROBLEM—Precision components of these machines—produced in average lots, ranging from 100 to 300 pieces—are of 303 stainless steel. Required machining tolerances were .0005", and surface finishes of 40 micro-inches had to be held in order to keep subsequent polishing costs to a minimum.

SOLUTION—Federal's new Warner & Swasey No. 4 Ram Type Turret Lathe adequately meets the desired accuracy and surface finish specifications—and, in addition, has increased production three times above rates obtainable on their older turret lathes.

YOU CAN PRODUCE IT BETTER,

HOLDS .0005" ACCURACY...

triples production rate

for Federal Mfg. Co.



OPERATOR REPORTS—"Ease of machine handling made possible our sizable production increase. We make full use of the lathe's 6 to 1 high-low shift and two-speed motor which instantly and effortlessly provide a choice of four speeds without preselection—a time-saver for changing speeds from turn, to ream, to cut off, etc. In all, our new No. 4 all-clutch hydraulic headstock, with its two-speed motor, provides a total of 24 *unduplicated* speeds—any of which can be preselected while under cut, and instantaneously thrown into action by the flip of a lever. We also like the higher speeds and the easier, faster handling of the apron controls."

This is the kind of production you can expect in your own shop when you replace older turret lathes with modern Warner & Swaseys. Call in our Field Representative to talk about specific applications in your shop.

**WARNER
&
SWASEY**

Cleveland

PRECISION
MACHINERY
SINCE 1880

FASTER, FOR LESS... WITH A WARNER & SWASEY

For more information fill in page number on Inquiry Card, on page 275

MACHINERY, November, 1956—27

Speed Precision Boring

and maintain accuracy of .0002" in 12" with the

Kearney & Trecker Model B Autometric Precision Boring Machine

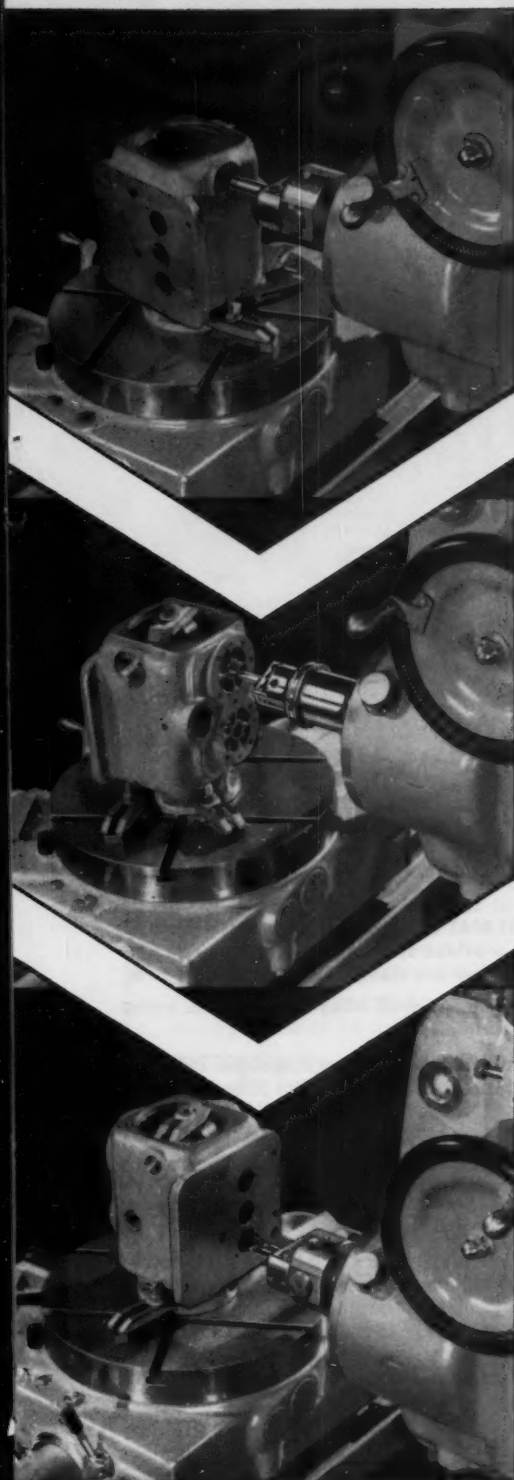
Here it is... unmatched for precision boring of small work... either single pieces or production lots! Work progresses rapidly on the versatile Model B because multiple boring operations can be completed in *just one setup*. These additional features save time, eliminate errors, and make the rugged Model B easy to operate...

Convenient operating controls • Ease of control
• Ease of setup • Built-in index table and measuring instruments • Wide range of feeds and speeds
• Complete line of especially selected accessories.

Model B Autometric: 16" dia. table; 10" Vert. Travel; 16" Transverse Travel; 15" Carriage Travel; 8 speed changes—.0005" to .0148" per Spindle rev.; 50 to 2500 rpm. For complete details, ask for Catalog No. BMA-10.



Designers and Builders of Precision



An inexpensive centering plug is used for locating the workpieces for boring operations, illustrated in the three adjoining application photographs.

Standard tools are used for boring jigs and experimental parts, while the simplest of special boring tools suffice for production boring.

The Model B Autometric Precision Boring Machine is equally efficient when boring workpieces singly or in production lots.

ATLANTA, GA.
Scott Machine Tool Co.
411 Williams St., N.W.

BIRMINGHAM, ALA.
George M. Meriwether
Industrial Equipment
1712 Seventh Ave. North

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Scott Machine Tool Co.

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Machinery Co.
3713 Washington Ave.

ST. PAUL, MINN.
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Todd Machinery Co.
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SAN FRANCISCO, CAL.
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CANADA
MONTREAL
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WINDSOR
Williams & Wilson Ltd.

and Production Machine Tools Since 1898





New

ARMSTRONG

Armide CARBIDE INSERT TOOL HOLDERS



STYLE TR
(opposite Hand TL)
Holds Triangular 6-edge,
Armide and other carbide
"throw-away" inserts.



STYLE SR
(opposite Hand SL)
Holds square, 8-edge,
Armide and other carbide
"throw-away" inserts.

**Embody... Convenience, Economy
Simplicity and Strength
based on these superior features:**

- **IMPROVED CLAMPING METHOD**—speeds indexing of inserts.
- **REPLACEABLE SEAT of Hardened Tool Steel**—protects shank and provides flat base to prevent damage to inserts as they are clamped in position.
- **SHANK of Heat Treated Alloy Steel**—gives extra strength and rigidity.

A slight turn of a single screw permits rapid indexing of the ARMIDE insert—reducing down time to a minimum.

The use of ARMIDE "throw away" inserts provides the economy of multiedged inserts—triangular inserts have six, square inserts eight cutting edges. These are available in Utility or Precision finish and in three grades of ARMIDE: 350, 370 or 883.

Protection to the shank is given by the replaceable tool steel seat which prevents wear and damage to the shank and provides a flat base for the insert reducing the possibility of damage to the insert as it is clamped in place. A relief groove is ground into the seat providing clearance when a dulled insert with "built up" edges is turned over.

ARMSTRONG ARMIDE Carbide Insert Tool Holders are furnished in two styles and three sizes. Complete data on these tools is given in Bulletin CIT, mailed on request.



*Write for
catalog*

ARMSTRONG BROS. TOOL CO.

"The Tool Holder People"

W. ARMSTRONG AVENUE

CHICAGO 30, ILL.



switch **A ~~STITCH~~ IN TIME . . .**

If you are trying to patch up holes in your production schedule, then it's high time that you switched to CIMCOOL®, the world's largest selling chemical cutting fluid. Here's how CIMCOOL can save you money and increase your production.

- **CIMCOOL INCREASES TOOL LIFE** (and thus reduces down-time) because of its chemical lubricity.
- **FASTER SPEEDS** and feeds are possible because CIMCOOL cools faster, for it combines friction reduction and cooling capacity in a degree never before attained.
- **CIMCOOL COSTS LESS** than old-fashioned cutting fluids because it lasts longer. It also cuts labor costs for cleaning and changing. It virtually eliminates rancidity and foul odors. Because of its low surface tension and low adhesion to work and chips, there is practically no carry off. And CIMCOOL is clean—leaves no slippery film on hands, work or floor.

But these are only a few of the CIMCOOL Standard Concentrate advantages that will help you sew up savings in your plant. For complete details, consult your CIMCOOL distributor. He'll be happy to tell you all about CIMCOOL—as well as the entire family of CIMCOOL Cutting Fluids. Or contact us direct and we'll send one of our Cincinnati Milling-trained machinists to call on you—without cost or obligation. Write, wire or telephone Sales Manager, Cincinnati Milling Products Division, Cincinnati 9, Ohio.

*Trade Mark Reg. U.S. Pat. Off.

CIMCOOL CUTTING FLUIDS

CIMCOOL Concentrate—The famous pink fluid which still covers 85% of all metal cutting jobs. Effective, economical and clean.

CIMCOOL Tapping Compound—Permits the use of highest tapping speeds and increases tap life amazingly.

CIMPLUS The transparent grinding fluid with exceptional rust control. Also used for machining cast iron and as a water conditioner with CIMCOOL Concentrate.

CIMCUT Base Additive—For jobs requiring an oil-base cutting fluid. Added to mineral oils, it gives an economical mix for higher speeds and feeds.

CIMCOOL Bactericide—The most effective agent yet developed to overcome rancidity and foul odors.

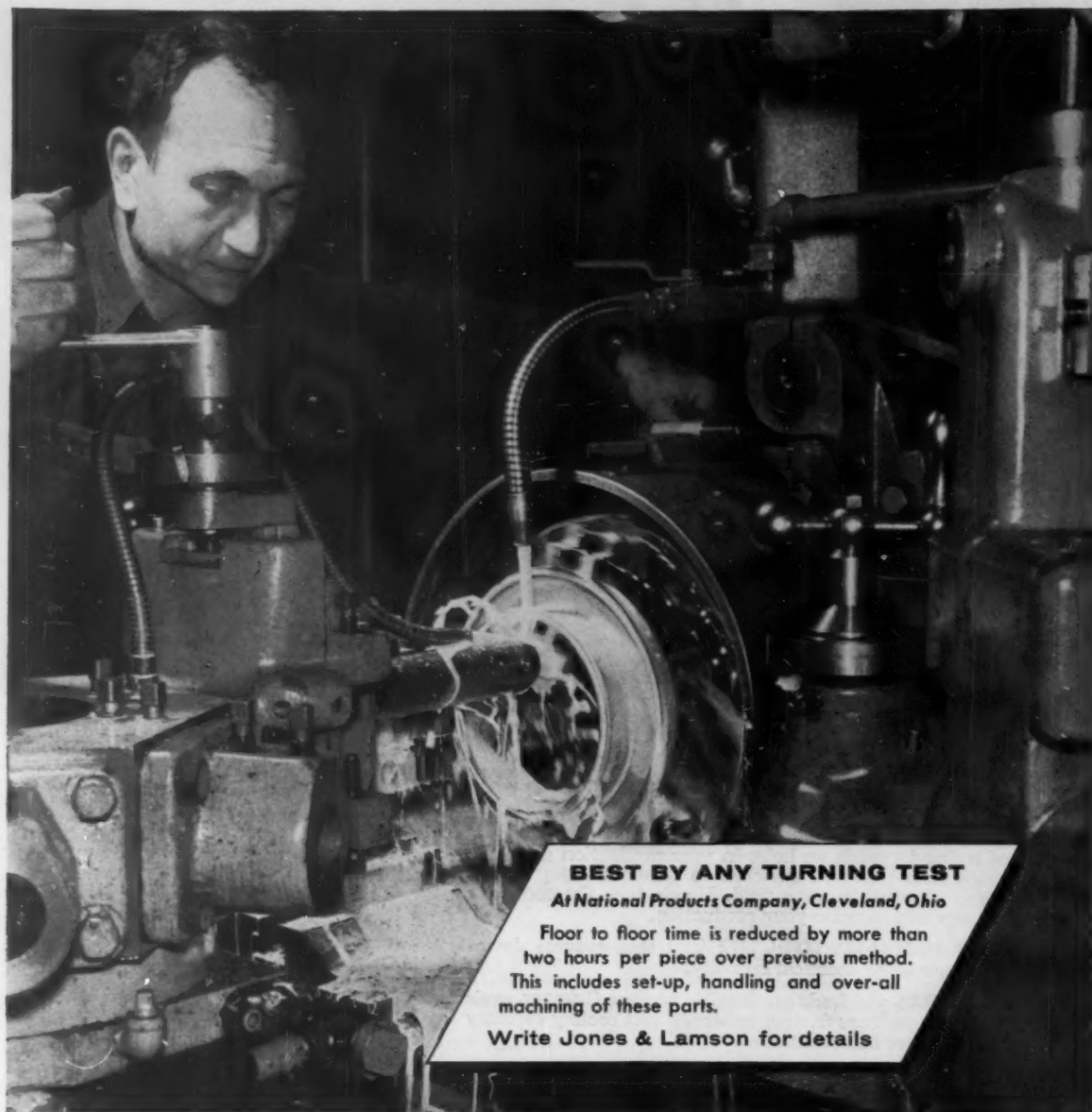
CIMCOOL Machine Cleaner—The two-phase non-corrosive cleaner that removes grit, dirt, slime and oil.

CIMCOOL

Cutting Fluids

for 100% of all metal cutting jobs

PRODUCTION PROVED PRODUCTS OF THE CINCINNATI MILLING MACHINE CO.



BEST BY ANY TURNING TEST

At National Products Company, Cleveland, Ohio

Floor to floor time is reduced by more than two hours per piece over previous method. This includes set-up, handling and over-all machining of these parts.

Write Jones & Lamson for details

**Jones & Lamson turret lathes are built and
powered to produce *MORE CHIPS* per tool
MORE PIECES per hour
MORE PROFIT per job
than any other turret lathe of comparable size!**

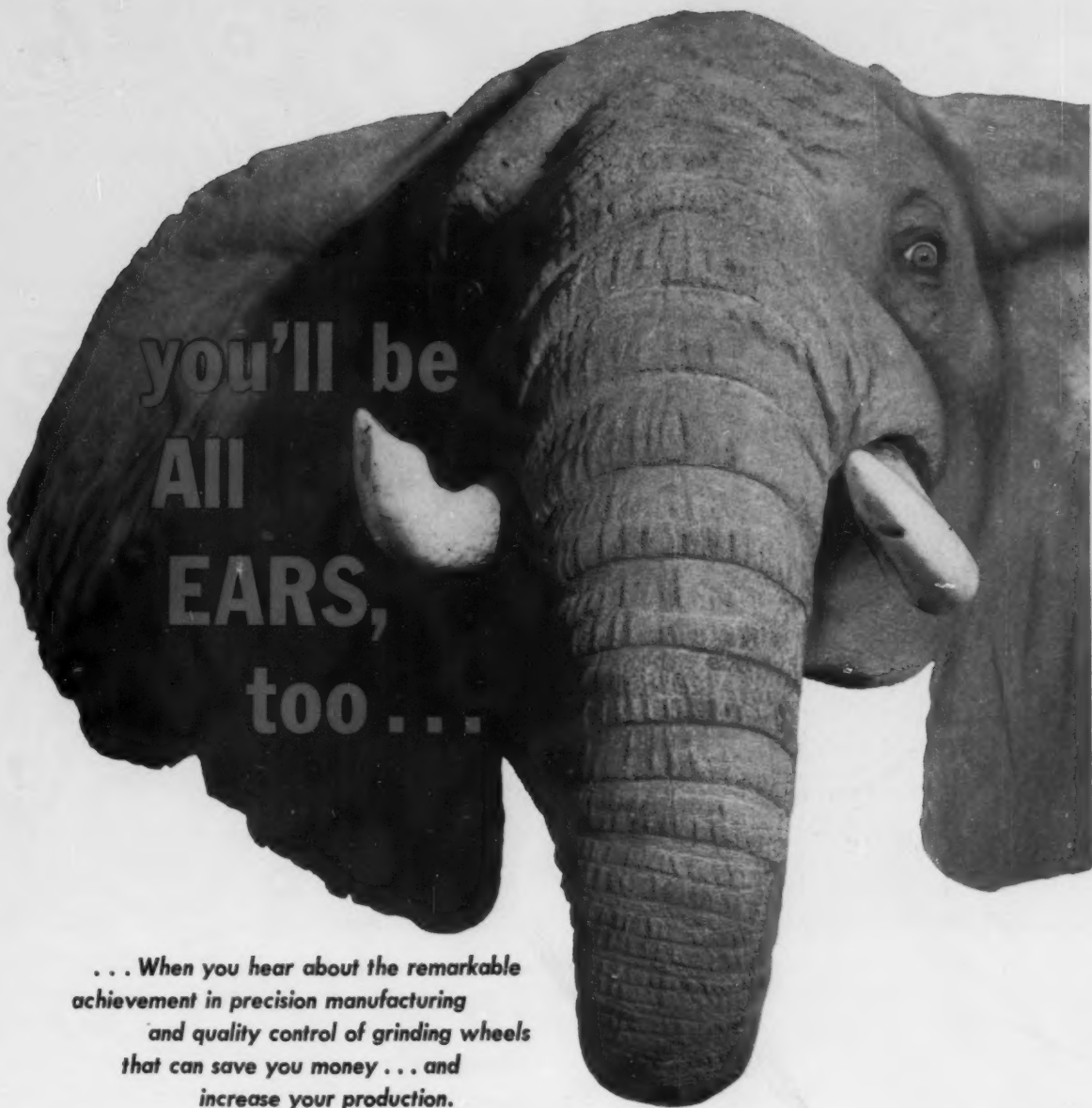
JONES & LAMSON

JONES & LAMSON MACHINE COMPANY, 512 Clinton St., Springfield, Vt., U.S.A.



the man who needs a new machine tool
is already paying for it

MACHINE TOOL DIV.



... When you hear about the remarkable achievement in precision manufacturing and quality control of grinding wheels that can save you money ... and increase your production.

It's **POSITIVE DUPLICATION**— offered *only* by CINCINNATI (PD)[°] Grinding Wheels.

Through the CINCINNATI (PD) Manufacturing Process you are assured Positive Duplication of the original wheel *every* time you reorder. "On grade" with a CINCINNATI (PD) WHEEL means all future (PD) WHEELS will act and grind exactly alike.

Yet CINCINNATI (PD) WHEELS are *priced no higher than ordinary wheels.*

So, if you don't have an elephant's memory, make a pencil note to contact your CINCINNATI Grinding Wheels distributor. Or, contact us direct and we'll send one of our representatives—men who know grinding and grinding machines as well as grinding wheels. Write, wire or telephone Sales Manager, Cincinnati Milling Products Division, Cincinnati 9, Ohio.

And don't forget this—*only* CINCINNATI Grinding Wheels give you . . .



POSITIVE DUPLICATION

A PRODUCTION-PROVED PRODUCT OF THE CINCINNATI MILLING MACHINE CO.

[°]Trade Mark Reg. U. S. Pat. Off.

CINCINNATI[°]

Grinding Wheels

For more information fill in page number on Inquiry Card, on page 275

MACHINERY, November, 1956—32A



To get clean wipers at the tool crib, this lathe operator must make the hike, then stand in line. Dirty wipers in hand, he makes the trip at least once a day, takes several minutes to do it.

He has to waste 60 minutes a week



Easy to distribute



Really soak up oil . . .



Always a clean one handy . . .



Just toss 'em in the trash . . .



With a carton of 125 clean Scott Wipers at every workbench, daily wiper replacement is often unnecessary. One carton can last for days and a man has a fresh supply right at his fingertips.

... He stays on the job The difference is... Scott Wipers

Check your production line. See how much time the men are forced to waste in order to keep supplied with fresh wiping material.

It adds up to more lost production time than you might think.

Scott Wipers are disposable. A man picks up a carton when he checks in . . . keeps it with him all day long. He uses one Wiper thoroughly—throws it away. Compli-

cated distribution is ended. So is sorting, baling, and laundering.

And with fresh Scott Wipers there's no danger of hidden chips damaging men or metal.

Your local Scott representative or distributor will demonstrate the Scott Wiper in your plant. Call him or mail this coupon today.

Another quality product of . . .

SCOTT PAPER COMPANY

Scott Paper Company
Dept. W-6, Chester, Pa.

Please send me more
information about
Scott Wipers.

Name _____
Company _____
Position _____
Address _____

Improved Gardner TRU-LOK® assures

ever see a **METAL SAW**

that thinks
for itself?

POSITIVE FEED
(MINIMUM PENETRATION)
FRICTION FEED

MARVEL SAWS'
Automatic "Brain"
Adjusts Blade
Feed Pressure
and Depth on
Every Stroke to

**GIVE YOU FASTER
CUTTING-OFF**

The exclusive automatic Dual Power Feed built into every MARVEL Series 6 and 9 Hack Saw is the "brain" that adjusts and compensates both pressure and depth of feed correctly in proportion to the number of blade teeth in contact with the work. Once the MARVEL Dual Feed is set, no operator attention is required to insure that the blade is cutting as deeply as possible and practical on every stroke . . . regardless of the changing area of the work being cut. Whether the Saw is being used for continuous automatic cut-off of identical pieces or a single cut, the MARVEL Dual Feed that practically "thinks for itself" guarantees that the work is cut-off in the fewest possible number of strokes.

Heavy duty MARVEL Series 6 and 9 Hack Saws embody every practical design and operating feature to give you speed, accuracy and operating economy you can find in no other metal cutting saws.

Write for the MARVEL
Catalog and complete
details on MARVEL
Saws

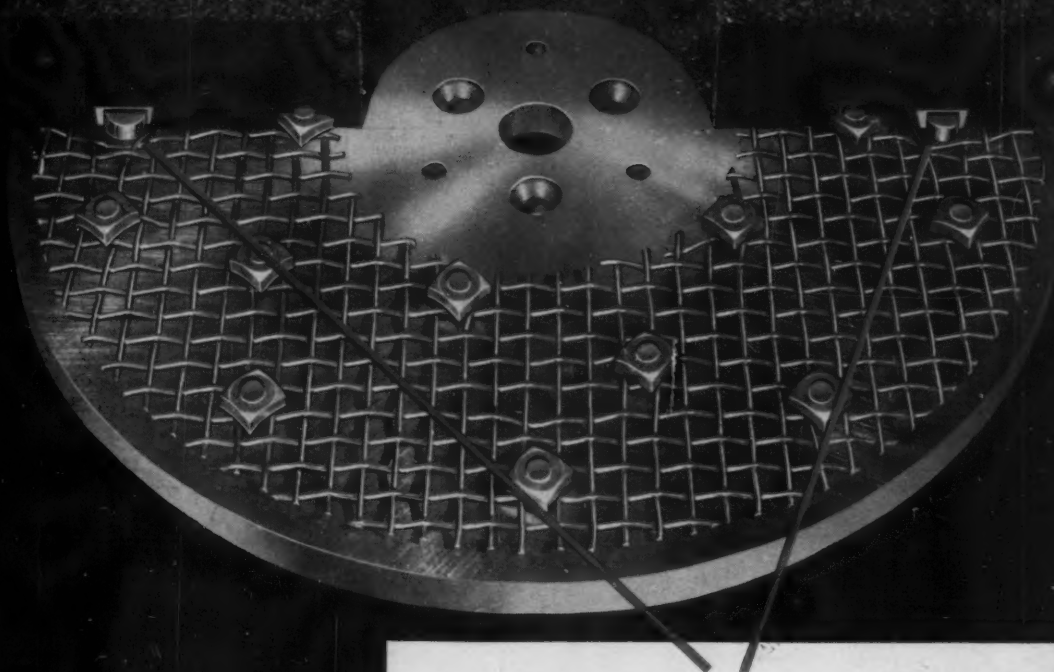


ARMSTRONG-BLUM MFG. CO.
5700 BLOOMINGDALE AVE. • CHICAGO 39, ILL.

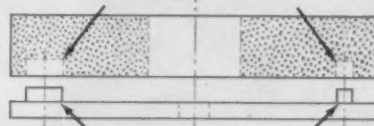
MARVEL *Metal Cutting*
SAWS
Better Machines—Better Blades

S-1304

Improved Gardner TRU-LOK[®] assures precision disc mounting for truer running



*Molded, rigid plastic inserts in dowel holes now
provide greater accuracy in mounting.*



*Dowel pins of different diameter in steel wheel must
match holes in disc.*

Gardner TRU-LOK eliminates run-out and vibration
caused by off-center mounting. Disc can be bolted to
steel wheel only in position established at time of disc
manufacture.

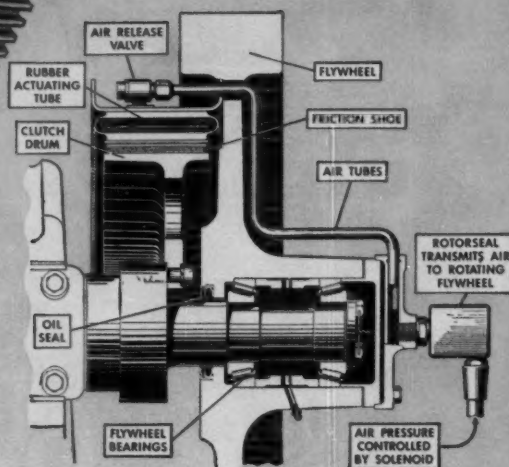
GARDNER
abrasive discs
BELOIT, WISCONSIN

Now you can

PRODUCE FASTER FOR LESS

with this 100-ton

FEDERAL
air-clutch press



Smooth-Air Clutch —
electro-pneumatically
controlled — 360° en-
gagement at maximum
diameter of drum.

These modern Federal Presses have what it takes to step-up production and cut unit costs! Their safe, precision, fatigue-free operation *at high speeds* may be attributed to the fast-acting clutch plus other outstanding features. Dual-solenoid safety valve. Non-repeat mechanism. "Inching" control. Continuous as well as single-cycle operation. In 6.6 to 100-ton capacities, these rugged presses embody the same superior materials and workmanship that have always distinguished Federal's construction.

Write for new catalog showing complete line.

FEDERAL PRESS COMPANY

601 Division Street, Elkhart, Indiana

FEDERAL *Open back Inclinable* **PRESSES**

31 Years of Quality Construction

ACCURATE GEARS at the touch of a



Highest accuracy over broadest work range at faster cutting speeds — that's the kind of overall performance available from a Farrel-Sykes "Twin-Head" gear generator. And because the machine is equipped with complete electrohydro control, you can take fullest advantage of its many benefits. For all operations, the machine responds instantly to the touch of push buttons on a conveniently located panel.

Built with high initial precision, the "Twin-Head" gear generator provides means of compensating for wear to sustain accuracy through many thousands of operating hours. And the accuracy inherent in the machine assures accurate tooth spacing, profile and helix angle in the gears it produces.

The "Twin-Head" machine makes fast, simple work of cutting every type of herringbone gear, single helical and spur gears with external or internal teeth, two members of a cluster gear at the same time, and other gears that operate on parallel axes.

We shall be glad to give you full details.

FARREL-BIRMINGHAM COMPANY, INC.
ANSONIA, CONN.

Plants: Ansonia and Derby, Conn., Buffalo and Rochester, N. Y.

Sales Offices: Ansonia, Buffalo, New York, Akron, Chicago, Los Angeles, Houston



Farrel-Birmingham®

FB-1084



time tested designing
with **MADISON-KIPP**
zinc and aluminum
die castings

The pumping unit is the most vital component in Madison-Kipp high pressure lubricators. The one here illustrated is used for pressures up to 2500 lbs.

Free use of iron and steel and brass inserts are features of many lubricator die castings as in the Aluminum Housing shown above.

The exacting service requirements of accurate measuring and forcing devices is something in which we have qualified as experts for nearly sixty years. Perhaps our time tested design formulas may be of help to you.

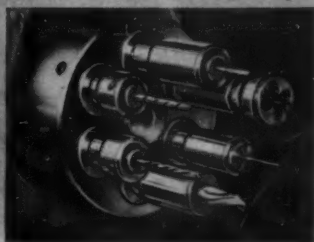
We will be pleased to review your blue prints.



MADISON-KIPP CORPORATION
303 WAUBESA STREET • MADISON 10, WIS., U. S. A.

• Skilled in Die Casting Mechanics • Experienced in Lubrication Engineering • Originators of Really High Speed Air Tools

Detail of drum turret showing six spindles



TURRET LATHE

VERSATILITY

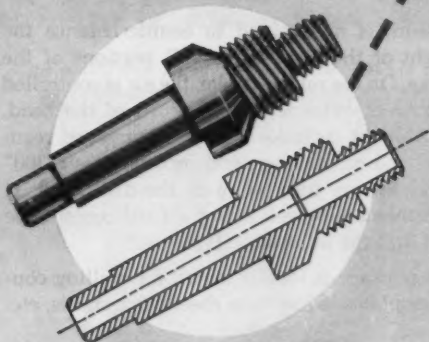
added to

SWISS AUTOMATIC PRECISION

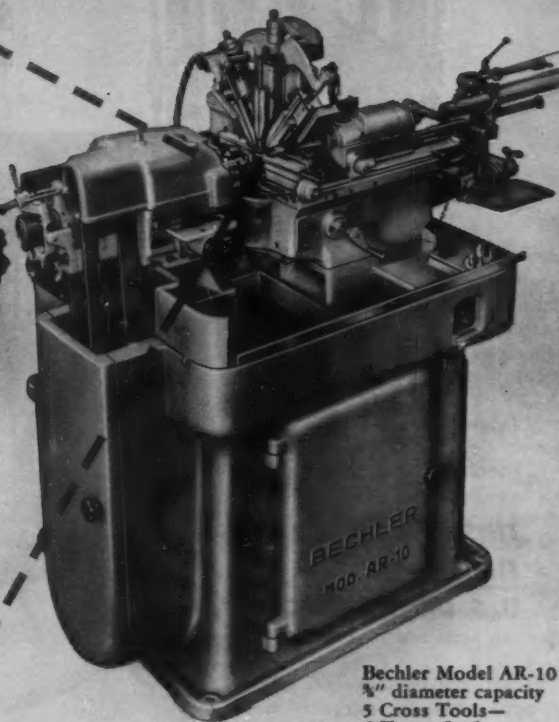
ONE MACHINE COMBINES
6-SPINDLE AXIAL DRUM TURRET
WITH 5 CROSS TOOLS

BECHLER
SWISS AUTOMATICS

This remarkable combination has resulted in a Swiss Automatic of tremendous versatility. Addition of a six-station drum turret permits a wide variety of set-ups with *simple, standard* tools. The 11 separate tool stations permit production of completely finished, precision parts. Secondary operations are eliminated—output is increased—yet the precise performance of standard Swiss Automatics is retained. These machines are available in three sizes with capacities up to 1½ inches.



Steel precision part produced on AR-10. Diameter—.250", length—.750", 1 single and 1 double lead thread, recess and taper behind shoulder, bores concentric with outside diameters.



Bechler Model AR-10
¾" diameter capacity
5 Cross Tools—
6 Turret Stations

TURRET FEATURES

- Six adjustable spindles—rotating or stationary—for centering, drilling, reaming, threading and tapping. Up to 4 of these spindles can be tooled for internal or external threads—right, left or mixed.
- Rapid, hydraulic spindle indexing—operated by standard, adjustable trip dogs instead of indexing cams.
- Accurate tool alignment—turret is securely locked on an extra large disc.
- Idle spindle travel reduced—horizontal turret positioned to suit length of workpiece.

COSA

—nationwide sales and service of precision machine tools—
—from bench lathes to boring mills.

COSA CORPORATION, 405 LEXINGTON AVENUE, NEW YORK 17, N.Y.

Factory Service: — Bechler Service Corporation — Long Island City — New York



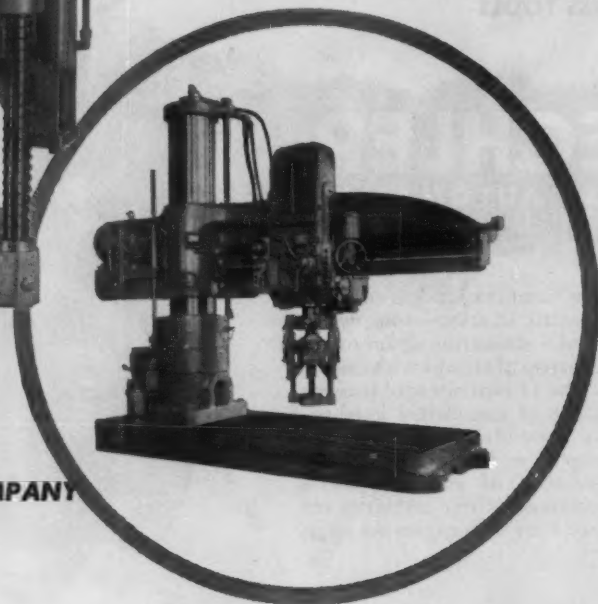
NEW

DRILL HEAD

AIR COUNTERBALANCE

SWIVEL ATTACHMENT

FOR RADIAL DRILLING MACHINES



**THIS IS ANOTHER
FIRST FOR THE
U. S. DRILL HEAD COMPANY**

This new combination Swivel and Air Counterbalance attachment makes it possible to adapt large multiple spindle drill and tapping heads to radial drilling machines.

Flexible and easily adjusted, it insures maximum safety for the operator, as well as better operating economy.

Two cylinders maintain a balanced condition of the head on the machine, with the air in the counterbalancing setup being controlled on both ends of the stroke. Therefore, only sufficient

pressure is maintained to counterbalance the weight of the head during all portions of the stroke. On the return stroke, the air is controlled to prevent extreme, quick return of the head. Attachment includes air filter, pressure regulator, and an air oiler, and incorporates a 360° swivel feature fully aligning the drill head. It operates equally well with the fixed center type head and the adjustable type head.

This package is ideally suited for drilling condenser plates, boiler tube sheets, flue sheets, etc.

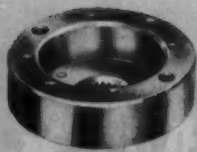
FOR MEN WHO KNOW DRILL HEADS BEST, IT'S ALWAYS U. S. DRILL HEAD — FIVE TO ONE



Manufacturers of all types of Fixed Center, Adjustable, and Individual Lead Screw Tapping Heads.

THE UNITED STATES DRILL HEAD COMPANY

BURNS STREET • CINCINNATI 4, OHIO

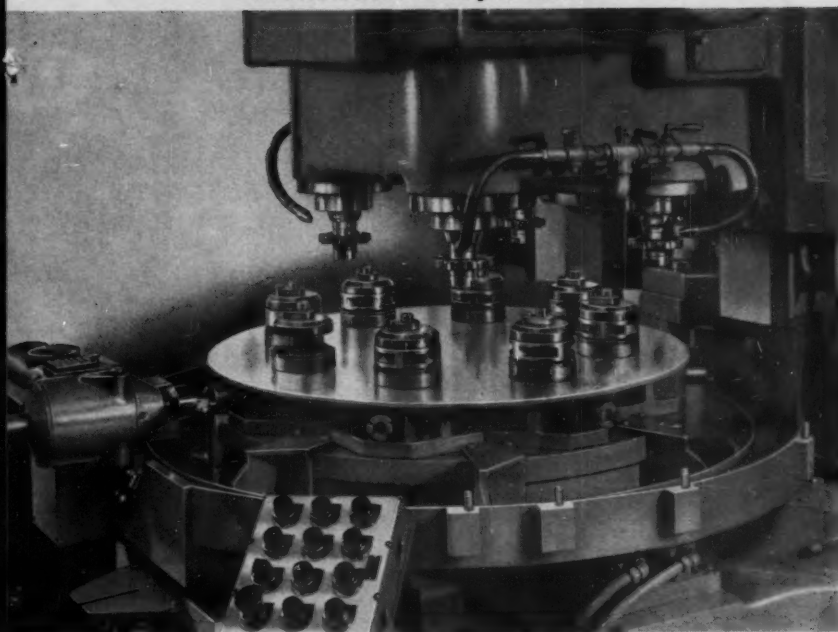


80 PARTS PER HOUR

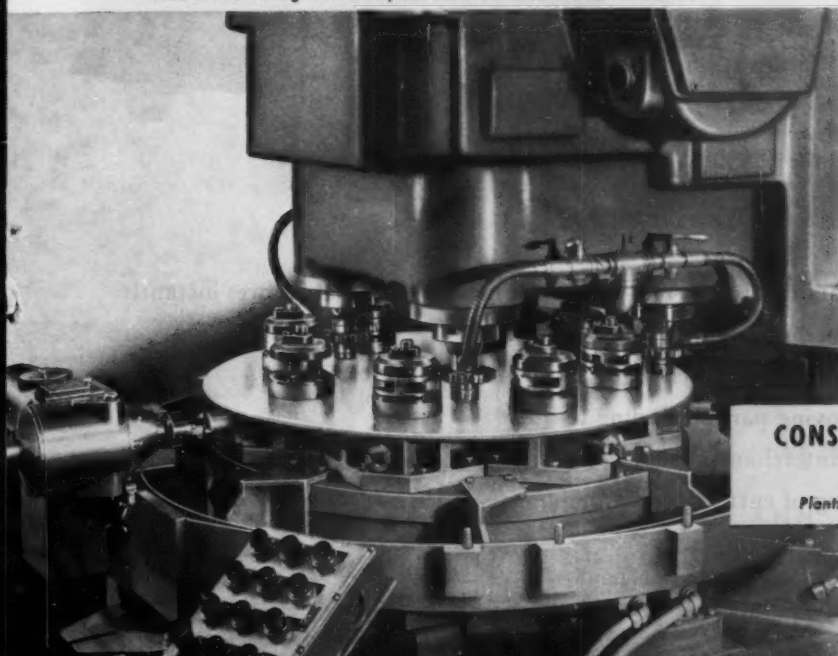


AUTOMATICALLY INDEX-MILLED on a Newton vertical rotary

The head raised for indexing the table.



Head at the milling level ready for the work to be fed to the cutters.



On the job at a leading automotive plant, the Newton vertical rotary in the photos turns out eighty finished parts per hour. All movements are hydraulic, and each index produces a finished piece—milled on four sides.

The cycle is as follows: (1) the head raises and the table indexes to a precision-locked position, (2) the head lowers to the milling level, (3) the table traverses and feeds in a straight line to the cutters and the work is milled to depth, (4) the table backs away in fast traverse and the head raises, (5) the table revolves for the start of the next automatic cycle.

The Newton vertical rotary has been designed to save time and energy in every phase of the operating cycle. For index milling, an NVR adds up to a substantial increase in production efficiency.

For more about Newton vertical rotaries, ask for bulletin 651.

CONSOLIDATED MACHINE TOOLS

Engine Lathes
Vertical Boring and Turning Mills
Floor and Planer-Type Horizontals
Planers, Double Housing and Openside
Planer-Type Milling Machines
Plate Edge Planers
Vertical Sloters
Rotary and Straight-Line, Production-Type
Milling Machines
Skin Mills for Aircraft Manufacturing
Circular Cold Saws
Railroad Wheel and Axle Machinery
Special Machine Tools

CONSOLIDATED MACHINE TOOL DIVISION

FARREL-BIRMINGHAM COMPANY, INC.

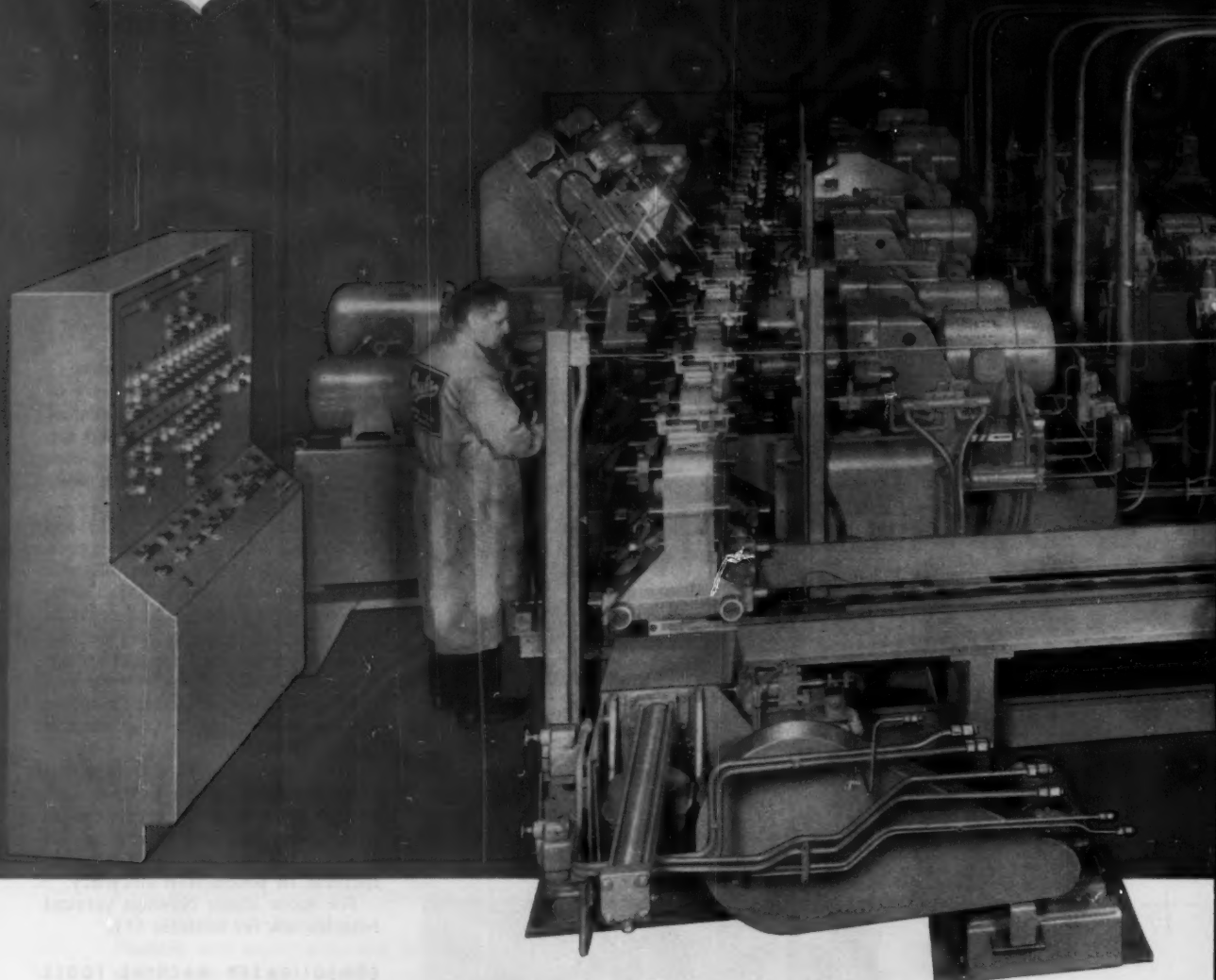
Rochester 10, New York

Plants: Ansonia and Derby, Conn., Buffalo and Rochester, N. Y.



Buhr

ECONOMATIC



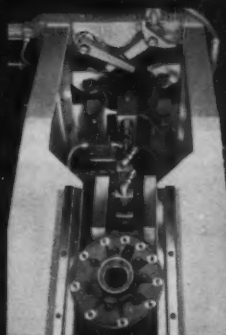
- Parts automatically clamped
- Automatic probing of tapped holes and deep holes
- Hydraulic back-up for heavy trepanning operations
- Automatic unloading of parts
- Exclusive Buhr Detector System in main console, signals and locates electrical failures instantly
- Fixtures washed on return to loading station
- Sectionalized bases to facilitate future part changes
- Automatic lubrication of all moving parts including fixtures
- All standard and special parts interchangeable for ease of maintenance
- Spindles arranged for pre-setting of cutting tools to minimize downtime for tool changes
- Hardened-and-ground steel ways
- J.I.C. Standards throughout

performs 55 operations every 23 seconds!

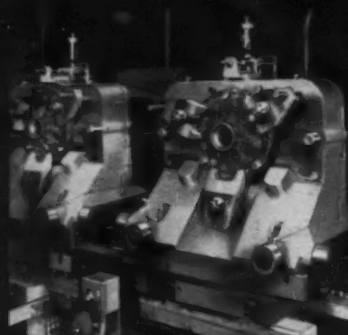


OPERATIONS...

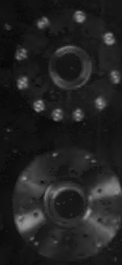
21 drilling, 20 reaming,
3 rough and semi-finish turning, 2 reaming,
1 end-milling, 1 semi-finish bore,
1 finish bore, 7 tapping and 9 probing



**CLOSE-UP OF AUTOMATIC
UNLOAD STATION**



CLOSE-UP OF FIXTURE



**PART
automotive front
pump-body**

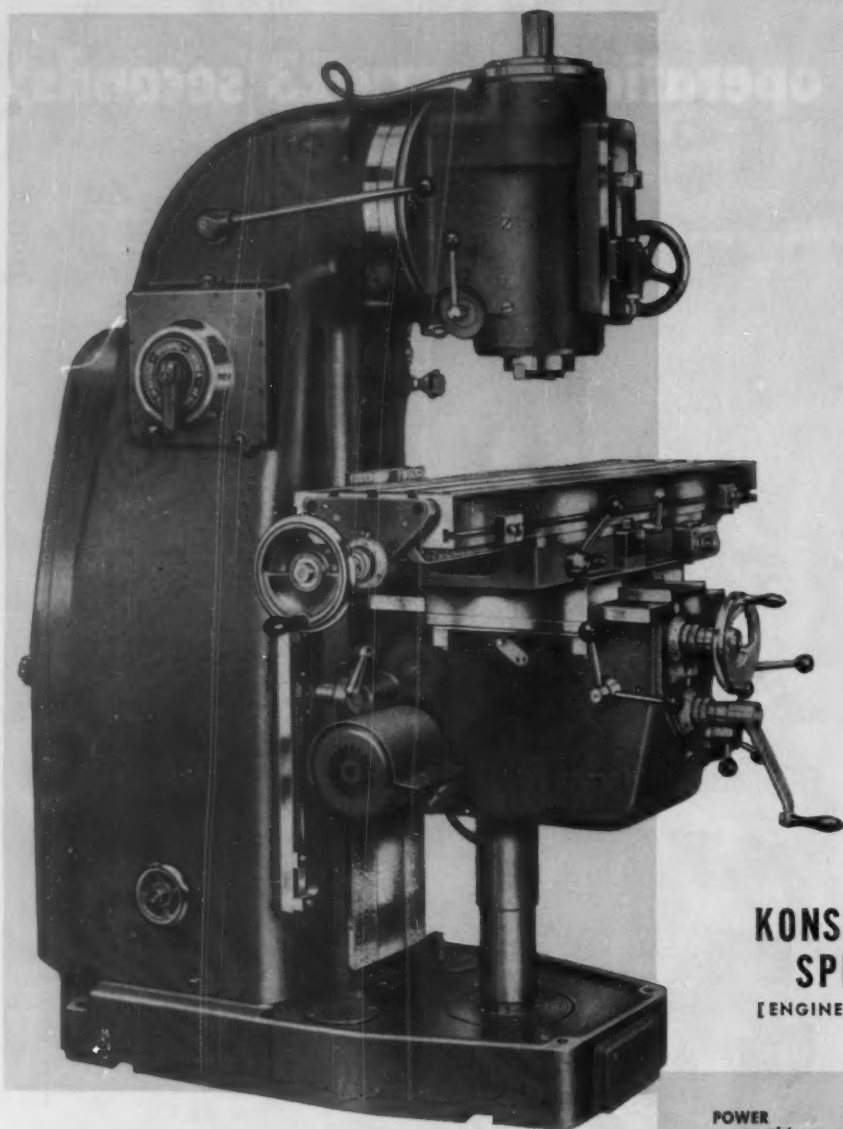


**MULTIPLE-SPINDLE
HIGH PRODUCTION MACHINERY**

BUHR MACHINE TOOL CO.®

ANN ARBOR, MICHIGAN

Solidly Engineered • Precision Built • for World's Leading Manufacturers



KONSTRUERAD FÖR SPECIALISTER

[ENGINEERED FOR SPECIALISTS]

SAJO'S NEW No. 2 VERTICAL MILLER MODEL VF-54

Built to U.S. Standards by Swedish craftsmen, this precision Miller meets exacting requirements at a modest price.

SAJO Model VF-54 is an ALL GEARED Vertical Miller with hand-scraped sliding surfaces, SKF "SP" anti-friction bearings on spindle and gear shafts, hardened chrome nickel gears, ground integral splines on gear shafts, externally adjustable back-lash eliminator for table feed screws, dial-selected feeds and speeds.

POWER

7½ HP motor for spindle (5 HP optional).
1½ HP motor for table feed and 3 direction rapid traverse.

RANGE

16 spindle speeds 39-1500 RPM (31-1200 optional), No. 50NMT spindle, 12 table feeds 1/8 to 25 inches/min. longitudinal and cross, 1/2 to 12½ inches/min. vertical. Power rapid traverse, all directions. Table travel 33½" long., 10" cross, 18" vertical.

CONTROLS

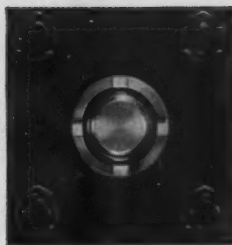
Single adjustable START-STOP-BRAKE lever. Dial selection of speeds and feeds (U.S. inch calibrated) with single lever controls. Magnetic motor starter.

FOR INFORMATION, CATALOGS, AND REFERENCE DATA, WRITE

austin INDUSTRIAL CORPORATION

76-E MAMARONECK AVENUE • WHITE PLAINS, NEW YORK

DEALERS IN PRINCIPAL CITIES • LOOK FOR THE AUSTIN SEAL... YOUR FULL GUARANTEE OF SATISFACTION



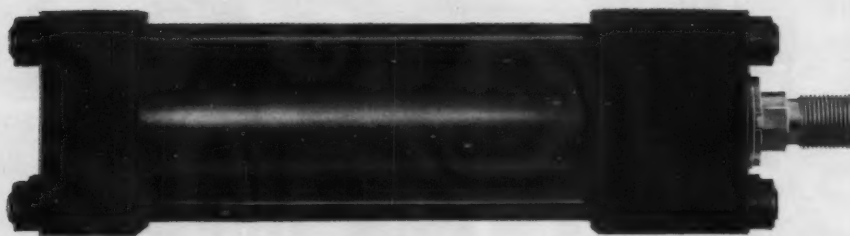
Here are the world's finest power cylinders ...competitively priced!

This ad is written for the man who has thought all cylinders are "pretty much alike." That just isn't so, and your Hannifin man would like an opportunity to show you why...

He'll show you design features that other cylinders simply do not have... extra quality workmanship at critical points that pays off in longer life... accessibility that simplifies their infrequent maintenance. And when he talks price and delivery, you will find these better features cost you no more, can often be delivered sooner.

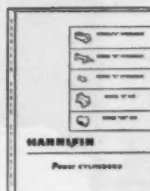
We think you'll agree that it pays to standardize on Hannifin cylinders.

AIR AND HYDRAULIC
HANNIFIN
POWER CYLINDERS



COMPLETE CYLINDER FILE

Write for your copy of this new Hannifin Cylinder File... complete, easy-to-use, easy-to-order-from information on five lines of Hannifin Cylinders. Write Hannifin Corporation, 509 S. Wolf Road, Des Plaines, Ill.



"Operations Kingsbury" . . . change die castings into interchangeable pump bodies

This oil pump body starts with a die casting. The piece is not machined prior to the time it enters the Kingsbury. When it leaves the Kingsbury, it's ready for assembly.

Work is required from three general directions: the mounting surface, the cover face and the top. It was decided to perform all operations in two chuckings, passing each piece through the machine twice.

The central column machine has 18 Kingsbury units — six with auxiliary heads. Twenty work-holding fixtures are mounted in pairs on an index table which indexes through ten stations — one for loading and unloading.

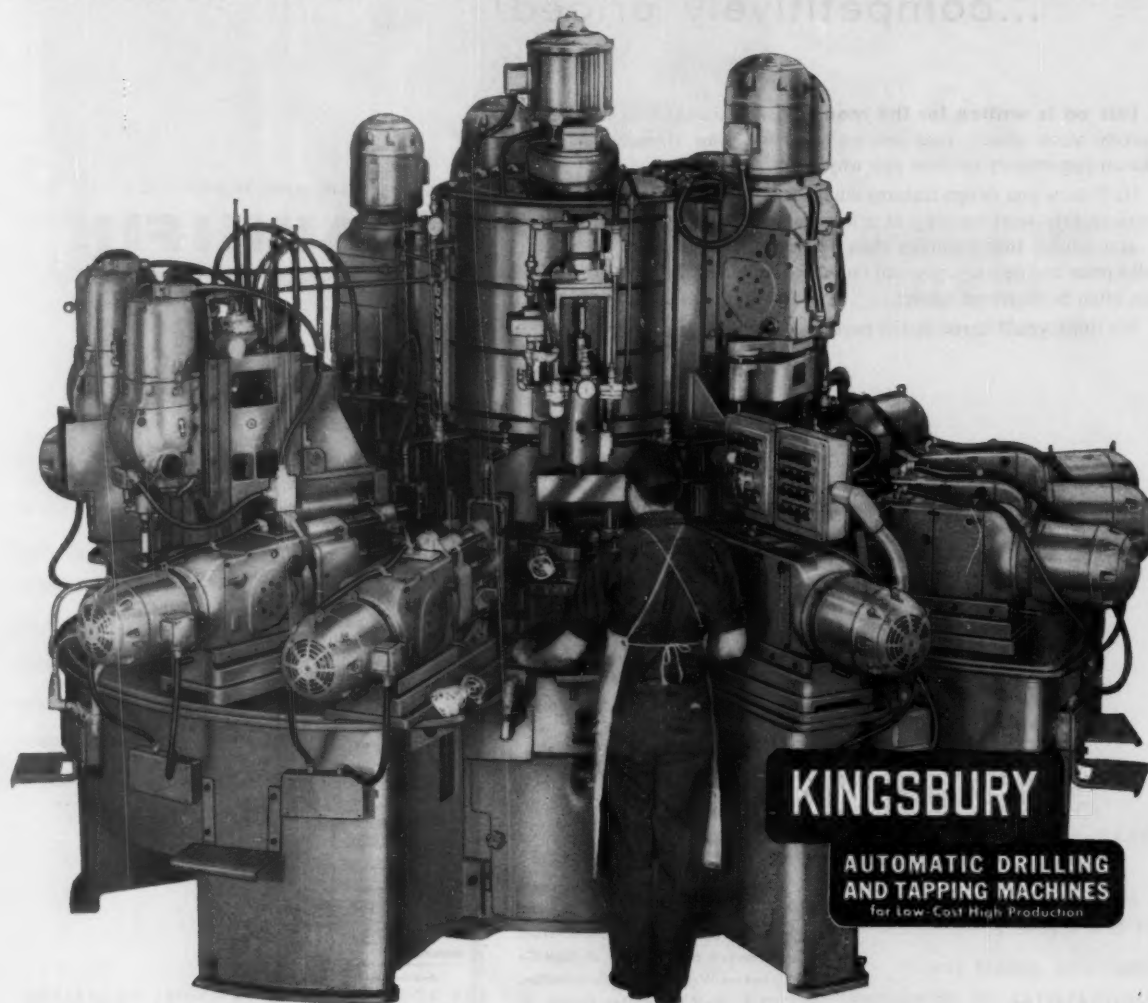
Operator places the die casting in the right-hand fixture, locating the pre-formed hole (No. 10) over a spring-actuated plug. A spring loaded ram closes the fixture, locating the piece correctly.

In the first trip through the machine, 14 spindles complete six holes and mill the mounting face. This work provides an accurate surface with precise locating points for the second chucking, in which 17 spindles complete eight holes and mill and trepan the cover face.

Result . . . each milled surface is uniformly accurate in finish and angle relationship — each hole is of proper size and is located correctly. Result again . . . interchangeability, which is what was wanted, plus rapid and economical production, of course.

An automatic machine cannot produce uniformly accurate work unless its work-holding fixtures are *designed correctly and precision-built*. You get both when you get a Kingsbury.

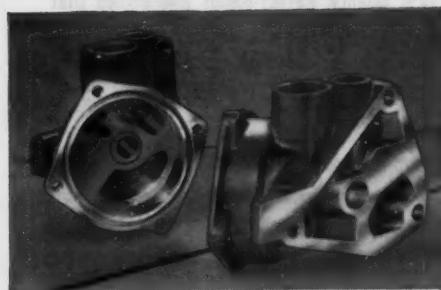
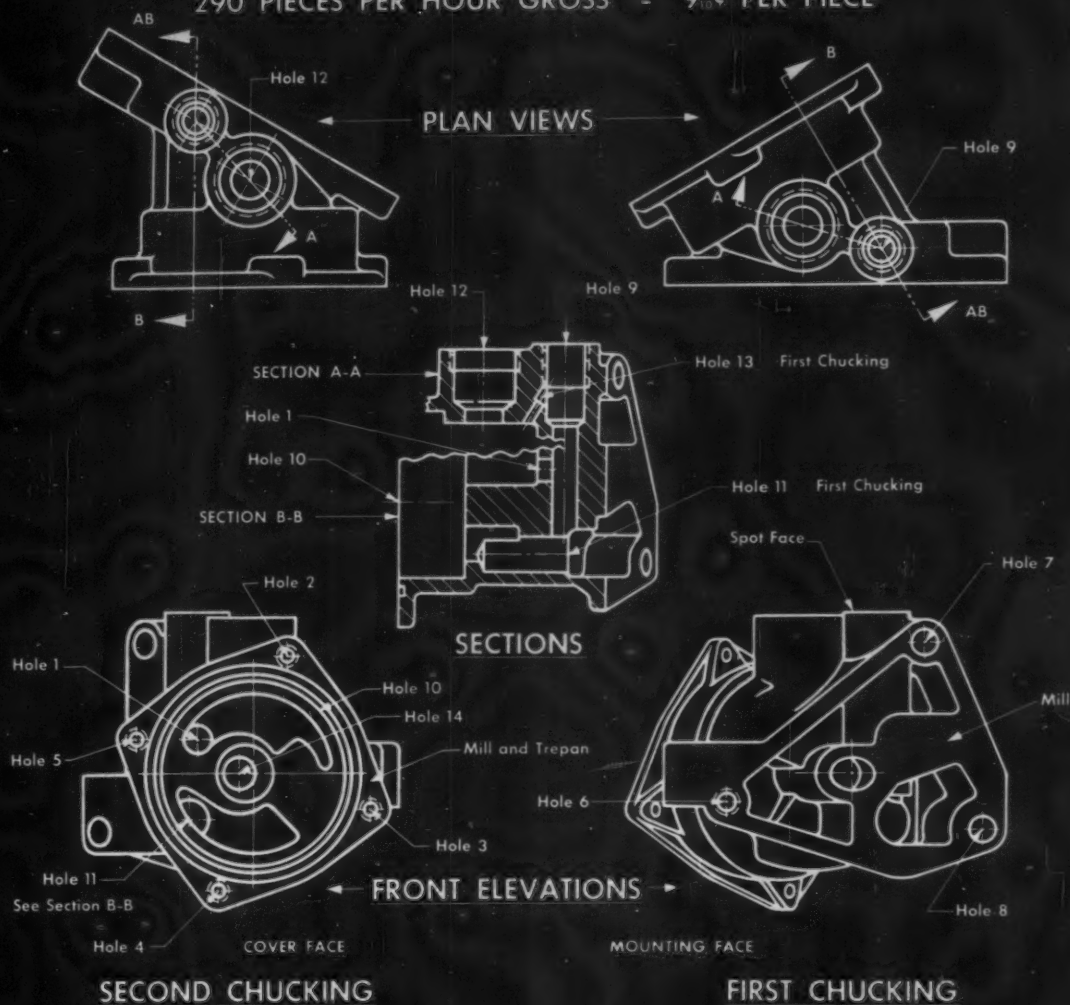
Kingsbury Machine Tool Corporation
120 Laurel Street
Keene, New Hampshire



OIL PUMP BODY-Aluminum Alloy Die Casting

32 SPINDLE OPERATIONS FROM FOUR DIRECTIONS

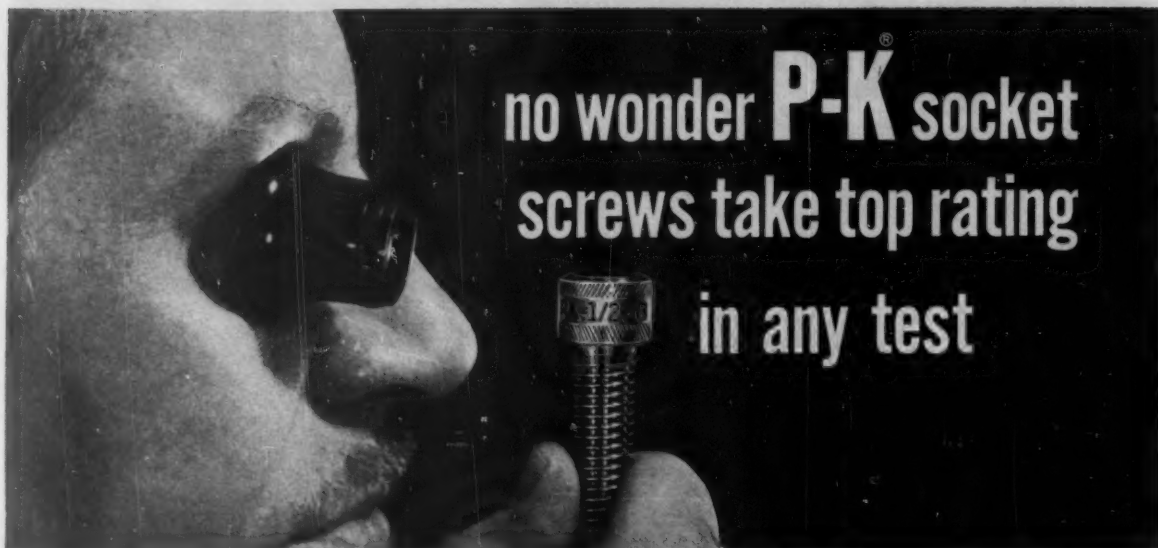
290 PIECES PER HOUR GROSS - 9¢ PER PIECE



Mirror photograph shows 13 of the 14 holes, and the two surfaces — completed in two chuckings.

FIRST CHUCKING		
HOLE NO	STATION	WORK
6	1-H	Tap Drill Undersize
	4-H	Ream
	8-H	Tap
7	1-H	Drill Undersize
	4-H	Ream
8	1-H	Drill Undersize
	4-H	Ream
9	4-V	Core Drill Undersize (two dias.)
	5-V	Spot Face Boss
	8-V	Ream
	9-V	Tap
	6-HR	Drill to remove Flash
13	7-AR	Drill
Mount Face	2-V	Mill

SECOND CHUCKING		
HOLE NO	STATION	WORK
1	1-H	Core Drill
2	1-H	Tap Drill
	3-H	Tap
3	1-H	Tap Drill
	3-H	Tap
4	1-H	Tap Drill
	3-H	Tap
5	1-H	Tap Drill
	3-H	Tap
10	4-H	Comb. Rough Bore*
	6-H	Finish Bore
	7-H	Finish Bore
12	7-V	Ream
	8-V	Tap
14	8-H	Rough Ream
	9-H	Finish Ream
Cover Face	2-V	MM
	4-H	*Comb. Trepan



no wonder **P-K** socket
screws take top rating
in any test



ROCKWELL HARDNESS TEST. With this familiar laboratory device, the hardness of screws is carefully tested as a check on heat-treatment.



PERFORMANCE. Both the raw material and finished screws are tested on this equipment to determine ductility and strength under tension loads.



HEX DIMENSIONS. To make sure that the hex meets exacting specifications, a team of inspectors check dimensions across flats at the machine.



HEAD DIAMETERS. As heads are shaved on automatic machines, such as those shown here, constant checking by operator and inspector maintains accuracy.



THREAD CONTOUR AND LEAD. The Comparator permits checking of thread contour and lead of screw heads against Class 3A Tolerances.

SEE FOR YOURSELF

These are just a few of the steps in the rigorous test and inspection routine conducted in Parker-Kalon's modern fastener plant. Exacting quality control assures that all "doubtful screws" are eliminated—that every P-K Socket Screw delivered to you is first quality. Parker-Kalon guarantees that it's first quality. In strength, dimensional accuracy and overall uniformity, you can be sure . . . "if it's P-K, it's O.K."

PARKER-KALON[®]

fasteners

Sold Everywhere Through Leading Industrial Distributors
Factory: Clifton, New Jersey—Warehouses: Chicago, Illinois—Los Angeles, California

PARKER-KALON DIVISION, General American Transportation Corporation
Manufacturers of Self-tapping Screws, Socket Screws, Screwnails, Masonry Nails,
Wing Nuts and Thumb Screws.

WORTH ITS WEIGHT IN GOLD

R and L TURNING TOOL

Here are
the tools which
the R and L
TURNING TOOL replaces:

Roller Box Tool.....	\$ 70.50
Centering & facing tool	\$ 20.50
Knee Tool.....	\$ 34.25
Pointing Tool.....	\$ 33.25
Back Rest.....	\$ 24.50
Floating Drill Holder....	\$ 11.50
Balance Turning Tool....	\$ 44.00
	\$238.50
Same for left hand.....	\$238.50
	\$477.00

One R and L Turning Tool
of similar size (No. 1)
costs only \$87.50 . . .
See what we mean
by being "Worth its
weight in gold"?

14 TOOLS IN ONE

**CHANGES FROM RIGHT
TO LEFT IN 10 SECONDS**

No misalignment . . . Extremely fine adjust-
ment provided . . . For rough and heavy cuts
as well as finishing cuts . . . The R and L
TURNING TOOL is constructed with best pos-
sible care and it is made of the finest steel!

Write for new catalog

RIGHT and LEFT TOOLS

1825 BRISTOL STREET • PHILADELPHIA 40, PA.

TURNING TOOL • CARBIDE OR ROLLER BACKRESTS • RELEASING OR NON-
RELEASING TAP AND DIE HOLDERS • RELEASING DIE HOLDER FOR ACORN DIES
• UNIVERSAL TOOL POST • CUT-OFF BLADE HOLDER • RECESSING TOOL •
REVOLVING STOCK STOP • FLOATING DRILL HOLDER • KNURLING TOOL

R and L TOOLS
1825 Bristol Street, Philadelphia 40, Pa.

- ☐ Send new catalog
☐ Please arrange for no-obligation
demonstration of R and L TOOLS

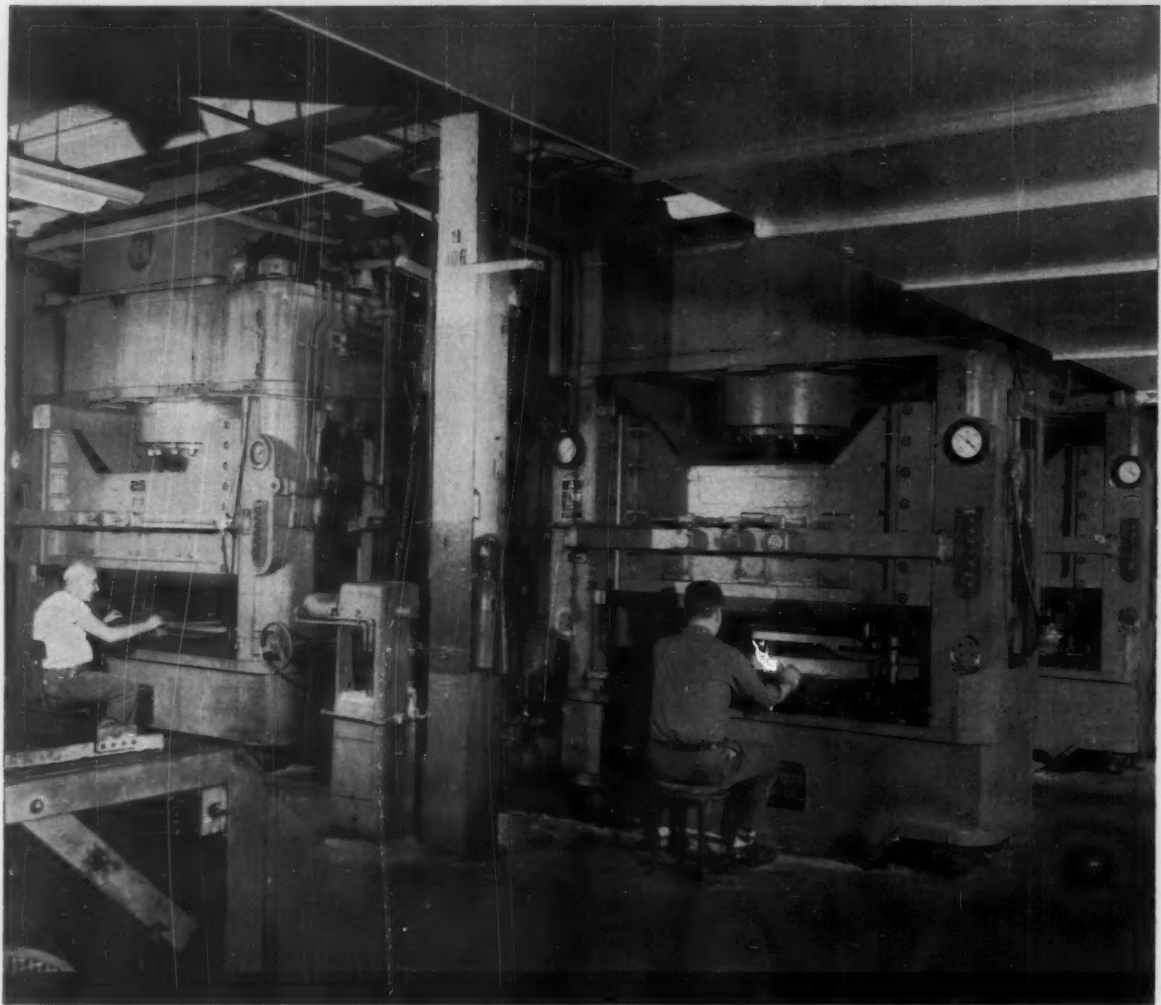
NAME

COMPANY

ADDRESS

M-11.

TO BE SURE IT'S H-P-M

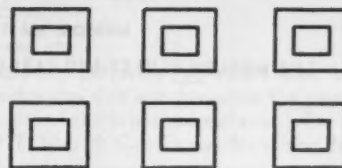
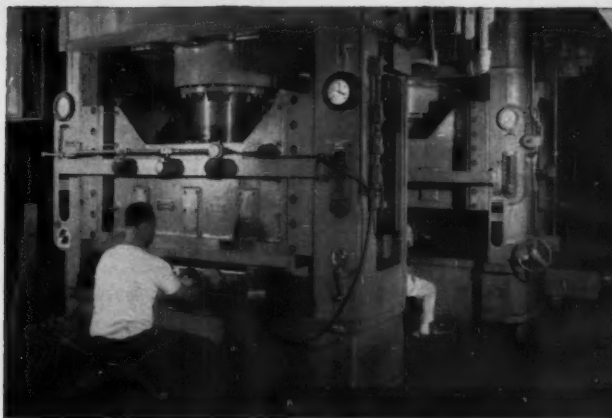


Material flows through this press department smoothly and efficiently. Special frames on these short stroke H-P-Ms permit use of presses in areas with low ceiling limits. H-P-M fits the equipment to the job without sacrificing normal press efficiency.

AT Westinghouse

■ The effective utilization of important floor space in today's busy plants calls for maximum production per square foot. At the Westinghouse Electric Corporation in Mansfield, Ohio, waste motion and waste floor space are eliminated wherever possible. Seven H-P-Ms, from 200 to 600 ton capacities, are fitted into a compact press room facility. Metal forming operations are concentrated in minimum space for greatest economy of operation and material handling.

H-P-M All-Hydraulic presses are versatile . . . adapt easily to modern metal forming jobs. H-P-M's exclusive closed-circuit FASTRAVERSE system of press operation is infinitely adjustable, permitting the press to be easily and quickly regulated for each specific application. Accurate control of drawing speed, plus total elimination of high impact stresses, guarantees proper metal flow. Independent control of each hydraulic action provides just the right tonnage for each job. H-P-Ms have become basic press room equipment for hundreds of industries both here and abroad. There's a reason . . . may we send you complete information?



What could you do with six H-P-Ms in a compact area like this? Let H-P-M engineers plan your complete press facility—show you how to be SURE with money-making H-P-Ms.

**THE HYDRAULIC
PRESS MFG. CO.**

Mount Gilead, Ohio, U.S.A.

A DIVISION OF KOEHRING COMPANY

HPM

working in tandem **IT TAKES ONLY**

for these two

LAPOINTE

BROACHING

to completely broach this front

1200 PARTS PER HOUR! That's fast production, and it's easily understandable that manufacturing personnel in one of the big automotive plants are delighted with the conversion to **LAPOINTE-BROACHING** for this part.

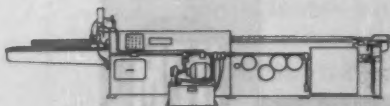
CARBIDE TOOLING on both machines is a helpful factor in achieving such high production. **THIS EXAMPLE** of what can be accomplished by engineers who are devoting their entire effort to the solving of broaching problems should suggest ways in which this modern method of metal removal can help you in your own plant! A Lapointe Field Engineer will gladly explain to you how Lapointe takes the responsibility for the entire broaching program: we design and build the broaching machines, design and build the broaching fixtures, design and make the broaches!

THE LAPOINTE MACHINE TOOL COMPANY

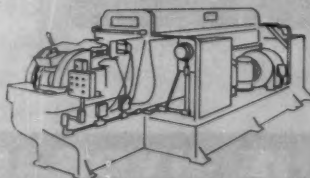
HUDSON, MASSACHUSETTS • U.S.A. In England: Watford, Hertfordshire

THE WORLD'S OLDEST AND LARGEST MANUFACTURERS OF BROACHING MACHINES AND BROACHES

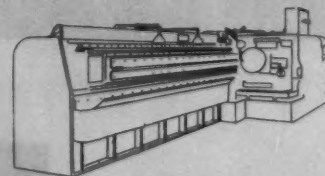
Here's a line of ELECTRO-MOTIVE DRIVE BROACHING MACHINES available only at LAPOINTE



60" STROKE HORIZONTAL, ELECTRIC



CH CONTINUOUS BROACHING, ELECTRIC



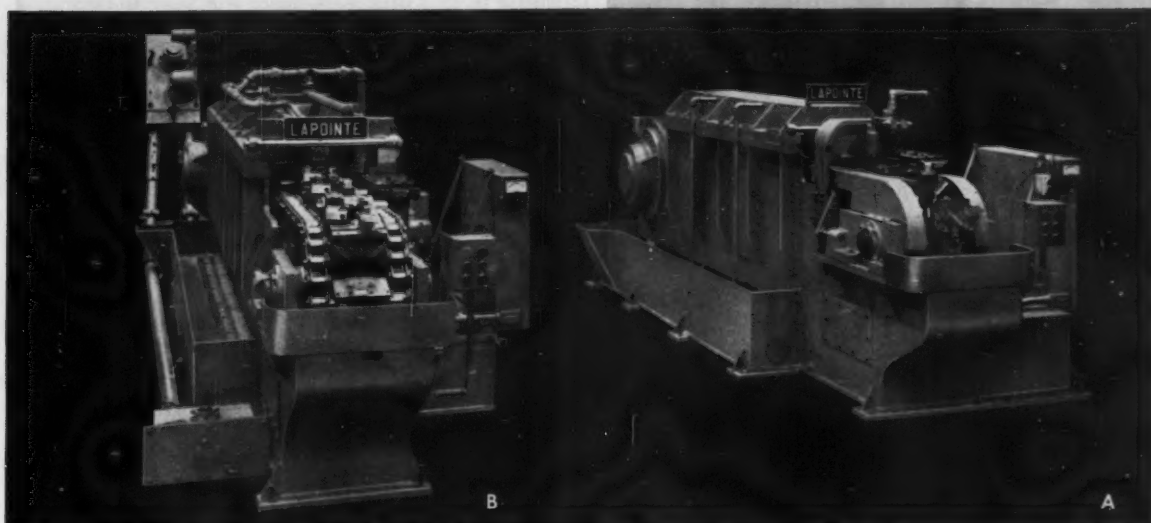
SRHE SINGLE RAM HORIZONTAL, ELECTRIC

3 SECONDS

CONTINUOUS

MACHINES

wheel brake cylinder!



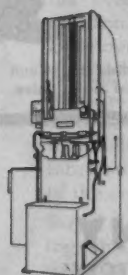
- Massive and rugged, exceptionally heavy construction.
- Matched twin-chain drive embodies strength far in excess of requirements.
- Segmented sprocket permits easy replacement.
- Multiple speeds possible.
- Electric brake provides sudden stop, to prevent damage.
- Broaches easily accessible, for inspection or changeover.
- Available in four standard sizes.

FIRST OPERATION (A)

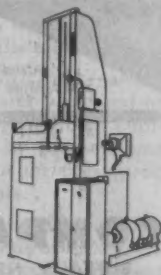
Broaching at 30 feet-per-minute, and equipped with 17 fixtures, this machine straddle-broaches the two sides of the part. The machine is the LAPOINTE 20/66 Continuous-Broaching Machine.

SECOND OPERATION (B)

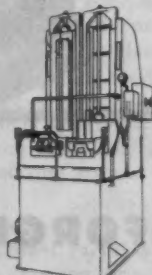
This machine actually performs two operations. Using 24 fixtures, it broaches the slot and broaches the pad. (Note the different angles of the broached surfaces.) The machine is the LAPOINTE 30/120 Continuous-Broaching Machine.



VUE-7 VERTICAL
PULL-UP ELECTRIC



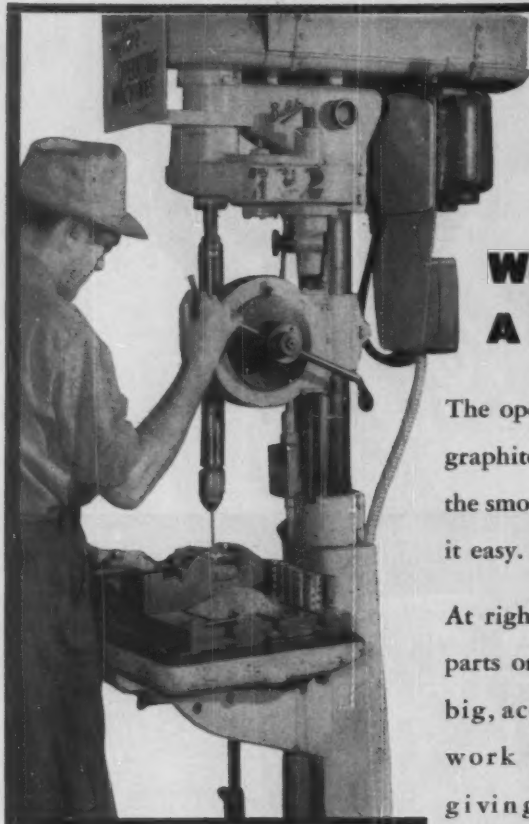
SRVE SINGLE RAM
VERTICAL, ELECTRIC



DRVE DOUBLE RAM
VERTICAL, ELECTRIC

LAPOINTE

known to be the best in
BROACHING



It's Easy

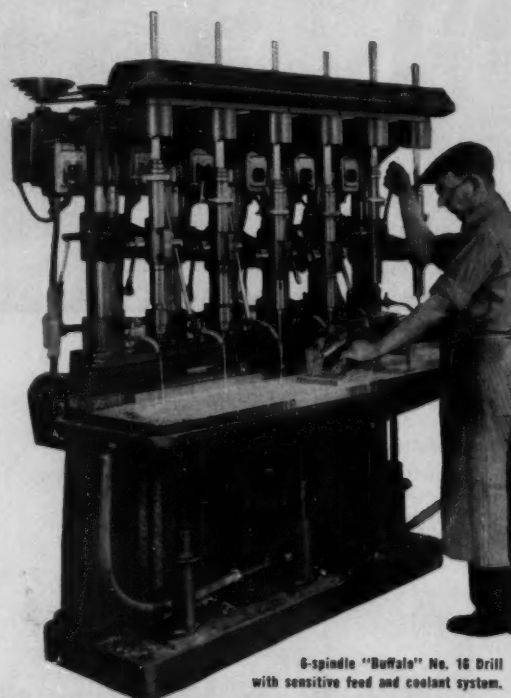
WHEN YOU'RE OPERATING A "BUFFALO" NO. 16 DRILL

The operator at left is making a long production run of graphite lubrication holes on a No. 16. Power feed plus the smooth handling of this precision-fitted machine makes it easy. Waste motion is eliminated, output high.

At right, the operator is drilling and reaming precision parts on a "Buffalo" 6-spindle No. 16 Drill. Notice the big, accurate work table, giving him plenty of tool-

ing space and visibility. The table-raising screw simplifies setups. And what you can't see — the true-ground 6-splined alloy spindles turning without deflection on adjustable-tension ball bearings — is the key to his accurate productivity.

It's all part of the "Q" Factor — the built-in Quality which provides trouble-free satisfaction and long life — whenever you've got a "Buffalo" Drill, Punch, Shear or Bending Roll working for you! Write for Bulletin 2730 for full details.



6-spindle "Buffalo" No. 16 Drill
with sensitive feed and coolant system.



BUFFALO FORGE COMPANY

440 BROADWAY

BUFFALO, NEW YORK

Canadian Blower & Forge Co., Ltd., Kitchener, Ont.

DRILLING

PUNCHING

SHEARING

BENDING

Loewy 50,000-ton "Major" forging press is automatically lubricated by Farval

FARVAL—
Studies in
Centralized
Lubrication
No. 196



● It takes only one man at the control pulpit to operate this huge 11-story press—the world's largest machine. Designed and built by Loewy-Hydropress Div. Baldwin-Lima-Hamilton of New York for the U.S.A.F. Heavy Press Program and operated by the Wyman-Gordon Co., it can exert 108 million pounds' pressure to form hot aluminum billets into structural parts for jet planes.

Adequate lubrication—and always dependable—helps this machine work to greater precision tolerances than ever before thought possible in a forging press. Lubrication is by Farval—a total of 205 bearings served by four systems—three heavy-duty automatics for the lubrication of the press proper and one manual for the lubrication of the controls.

Farval Centralized Lubrication Systems are serving millions of bearings in all kinds of industrial equipment. Farval is ready to serve you, too. Call the Farval representative near you, or write us for Bulletin 26-R. The Farval Corporation, 3276 East 80th St., Cleveland 4, Ohio.

*Affiliate of The Cleveland Worm & Gear Company, Industrial Worm Gearing.
In Canada: Peacock Brothers Limited.*

KEYS TO ADEQUATE LUBRICATION—

Wherever you see a Farval central pumping station, dual lubricant lines, and valve manifolds, you know a machine is being properly lubricated.

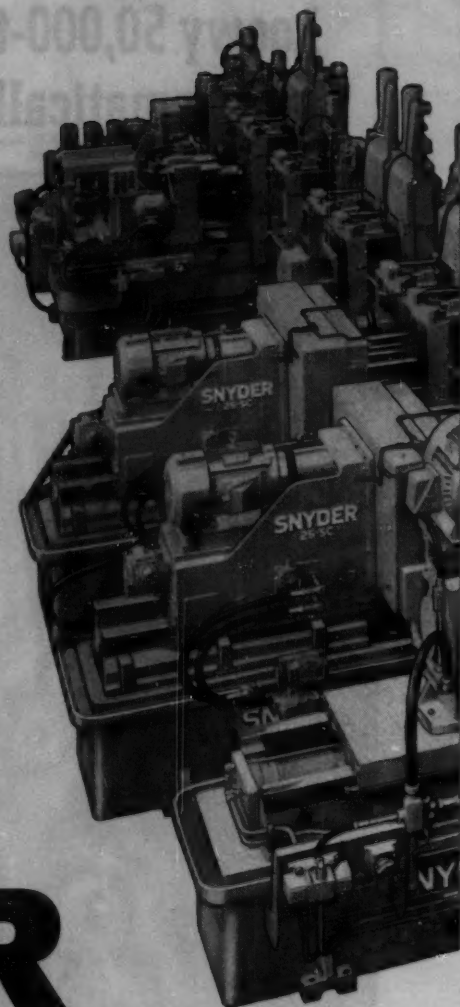
Three Farval heavy-duty automatic pumping stations that lubricate "Major" are to be seen at lower right.



UNIQUE FEATURES IN SNYDER 9-SEGMENT, 24-STATION, IN-LINE AUTOMATED TRANSFER MACHINE

for processing converter housings; independent control panels permit individual segment operation (co-ordinated with master panel); electric circuits can be individually checked by Circuit-Sleuth Panel; at Station 4, workpiece is re-oriented 90°; at Station 21, two dowel holes and one transmission hole are precision bored to .001 in size; at Station 22 these holes are automatically precision air gaged.

Workpiece reaches machine finish ground on both faces; machine performs 59 operations, delivers workpiece completed and automatically inspected. Production, 128 pieces an hour at 100% efficiency.

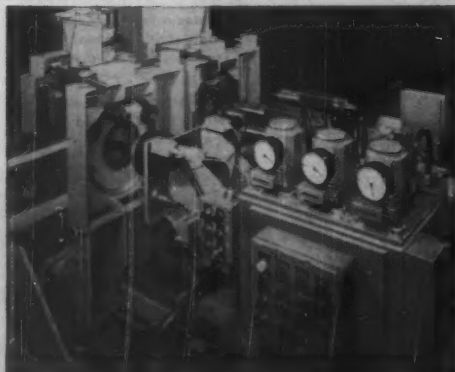


SNYDER

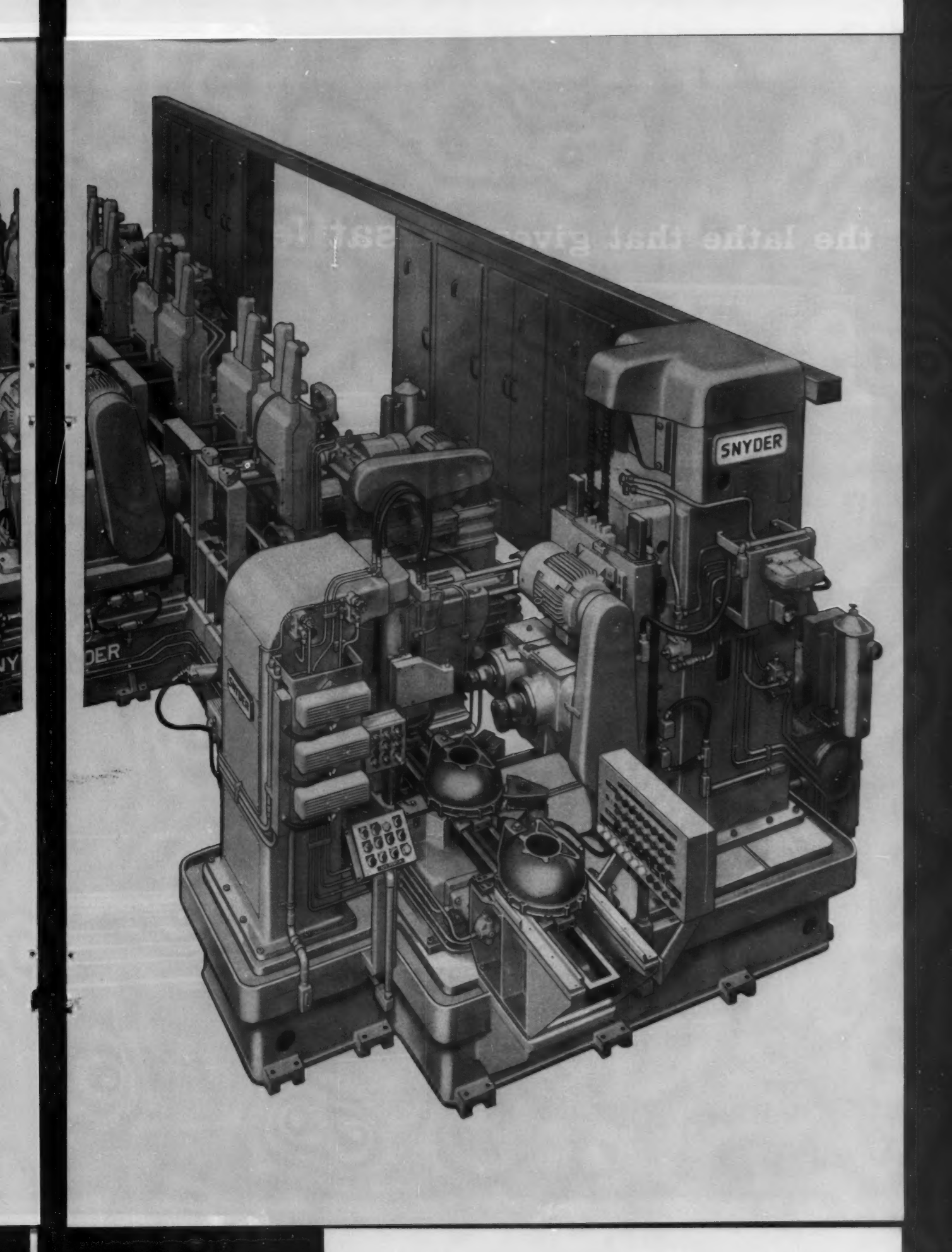
TOOL & ENGINEERING COMPANY

3400 E. LAFAYETTE • DETROIT 7, MICHIGAN

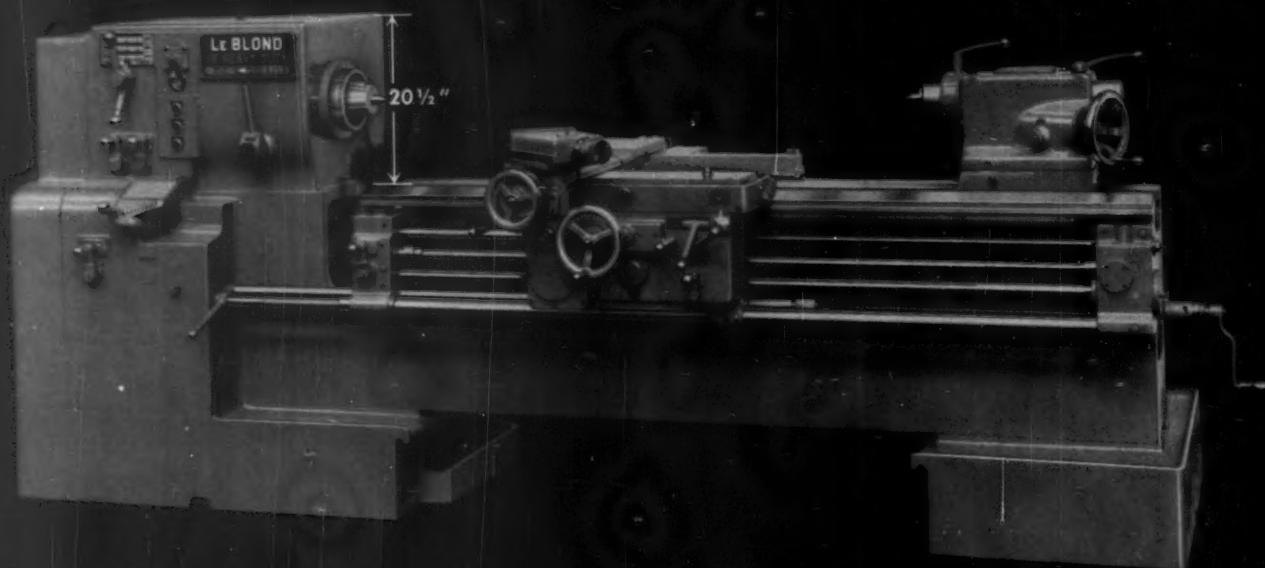
31 Years of Special Machine Tools with Automation



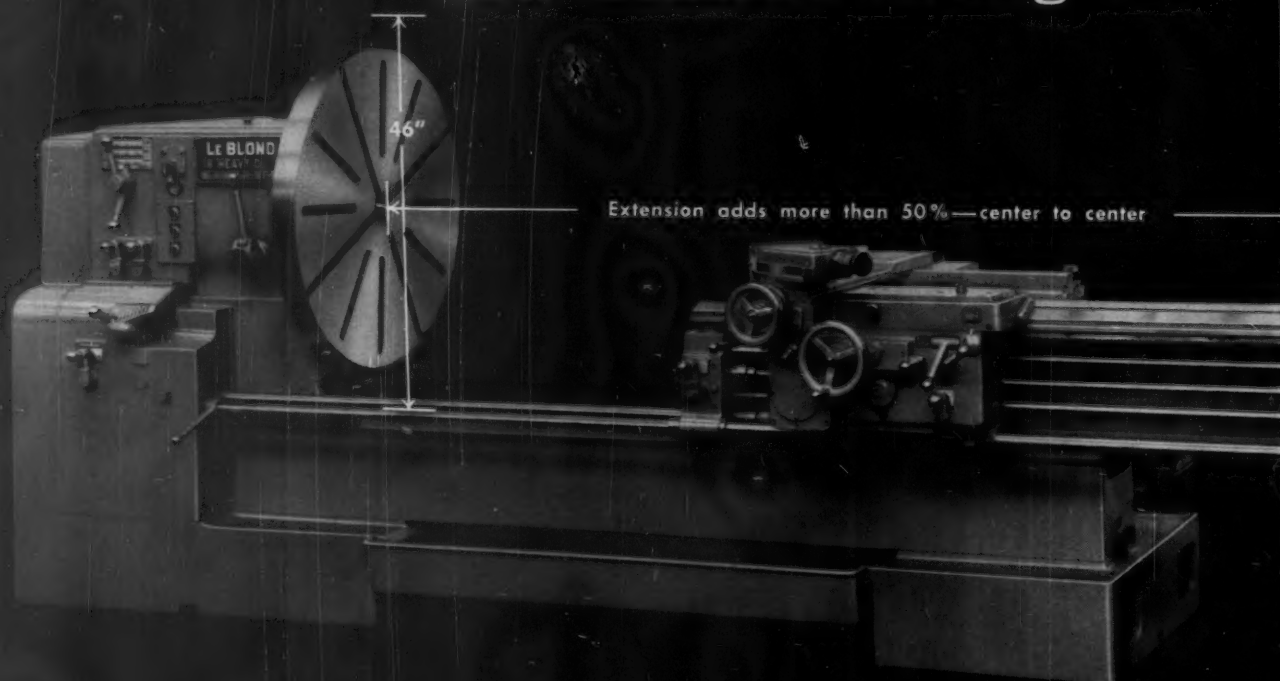
Boring and air gaging stations.



the lathe that gives versatile a new

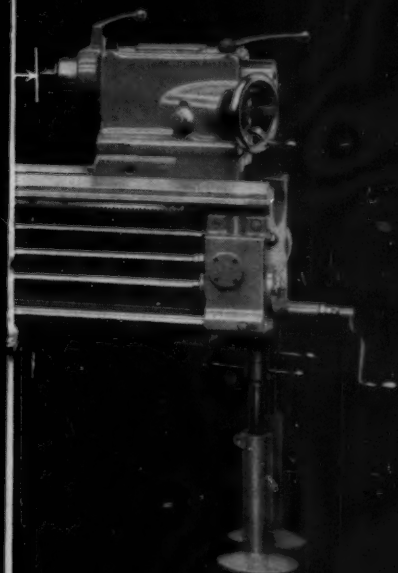


new LeBlond sliding bed



meaning!

gap lathe



Here's a lathe that is fundamentally different. It has a special bed that *slides* open to form a gap—gives you approximately *twice* the normal swing size. Sliding the bed also gives greater bed length, more than 50% greater distance between centers. And, with bed closed it functions as a regular engine lathe.

So, what we mean by a *versatile* lathe is one that actually changes shape to suit your odd-shaped parts. It handles all the usual work, plus a wide variety of large diameter jobs, extra long parts, and combinations of the two. "Swing size" as such is no longer a limitation. For example, here are some of the unusual capacities you can handle on the 16" LeBlond Sliding Bed Gap Lathe:

Face 38" diameters in one cut

Face 45" diameters in two cuts

Turn lengths more than 50% greater than normal center distance

With extension rest (optional): turn 27½" diameter, 13¼" length

With Full-Swing turning attachment (optional):

turn 45" diameter almost full length of gap

Other important features of the new LeBlond 16"/38" SBG Lathe include new spindle bearing design for high-speed turning, combination gear-belt drive headstock, 18 geared speeds, 9 timing belt-driven speeds from 8 to 2000 rpm, spur gear design, four-way rapid traverse, one-piece apron, totally enclosed quick change box, hardened and ground steel bedways, thrust-lock tailstock.

If you have a variety of parts to turn—particularly the unpredictable extremes you encounter in maintenance and job shop work—the LeBlond SBG may well be the answer. An economical answer, too! SBG's come in 4 sizes: 16"/38", 25"/50", 32"/60" Heavy Duties and the 17"/28" Regal. Like all LeBlonds they are built in every engineering detail to give you long dependable service.

Whatever your turning needs, there's a lathe in LeBlond's complete line to do the job. 76 different models to choose from. Call your LeBlond Distributor or write today.

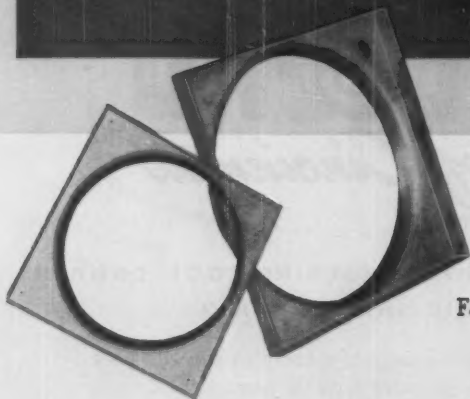
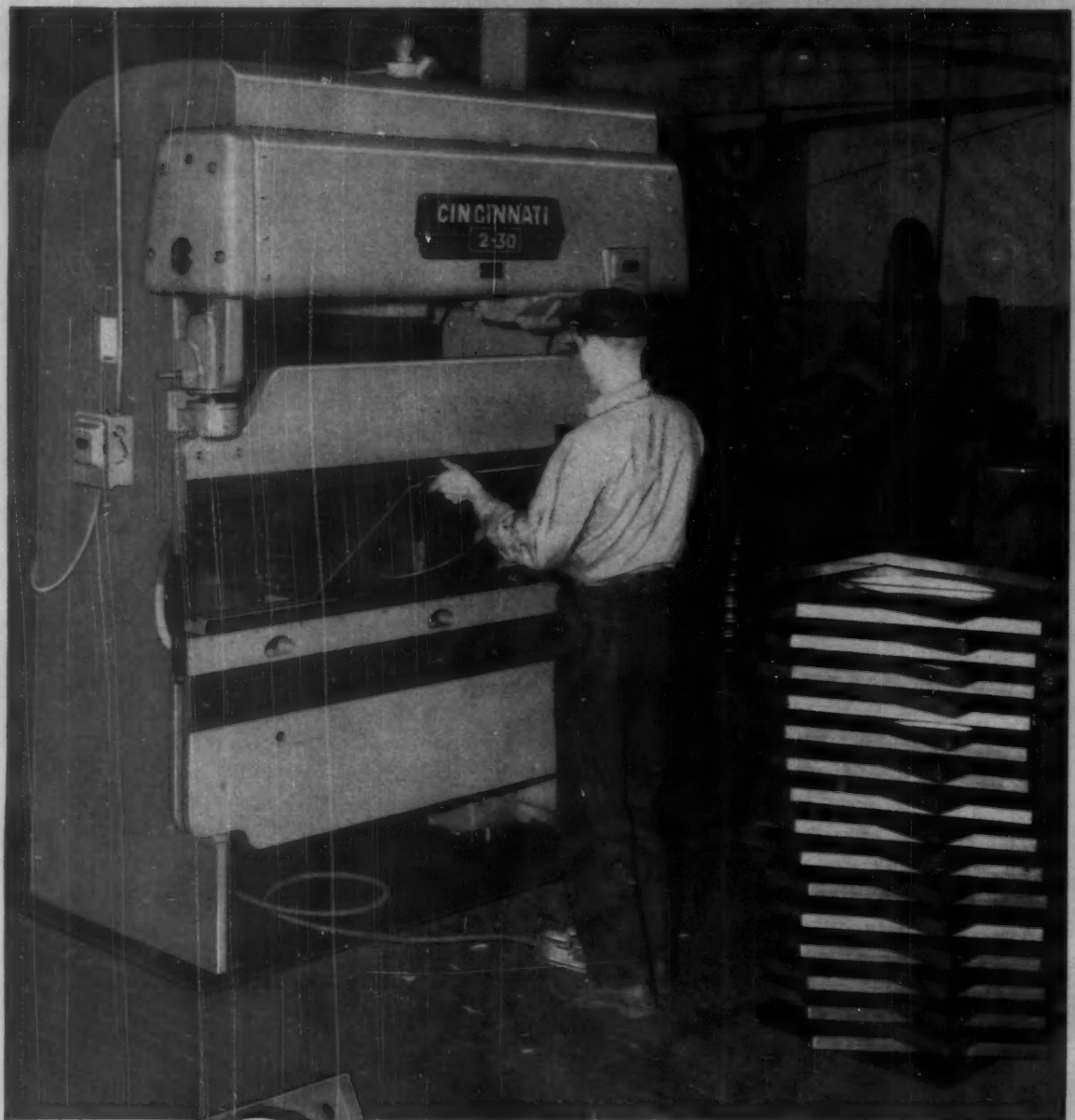
... out with confidence



THE R. K. LEBLOND MACHINE TOOL COMPANY
CINCINNATI 8, OHIO

*World's largest builder of a complete line of lathes
for more than 69 years*

This accurate Cincinnati



Fan casings.



Press Brake saves money and time...



Photos courtesy of Anchor Metal Spinning Company.

at **ANCHOR METAL SPINNING CO.**
Dayton, Ohio

Profitable production has been achieved by installing this Cincinnati Press Brake.

Accurate flanging of fan housings is done rapidly while meeting the rigid requirements for squareness. Operations on different sizes and gauges of materials are performed with ease. Parts for assembly are ready on time and smooth shop operation maintained.



Write for Bulletin "2 New Cincinnati Press Brakes" for complete information on these versatile machines.

THE CINCINNATI SHAPER CO.

CINCINNATI 25, OHIO, U.S.A.

SHAPERS • SHEARS • BRAKES





are you running hard...



THE CINCINNATI SHAPER CO.

ESTABLISHED 1858

SHAPERS • SHEARS • GRINDERS

CINCINNATI OHIO U.S.A.

Conservative studies of growth potentials and long range trends, by both industry and government, show clearly that markets are already outrunning the labor supply for industrial production. The pace will get increasingly faster as our growing population demands more goods and services.

Those companies which stay in the race will do so by stepping up their productivity per man hour, and planning their capital expenditures accordingly. They will not stumble over the problem of machines displacing men, because they know there will not be enough labor to fill all the jobs created in the next ten years.

Avey production machines have already increased productivity per man hour, per square foot of plant space, and per dollar of invested capital in many plants. Their fast rate of return makes it profitable and pleasant to stay in the running.

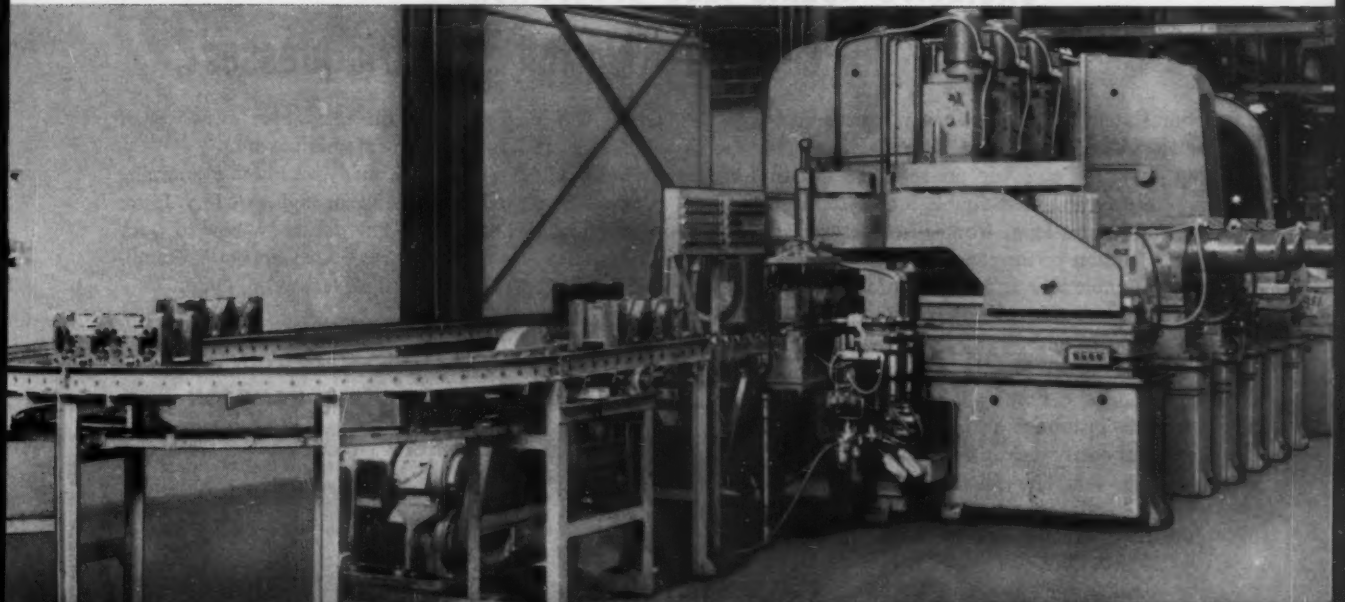
► **production data:** This machine automatically rough and finish mills, drills, countersinks, and taps 260 hydraulic pump covers per hour. Operations include automatic gauging, probing, and insertion of bronze bushing in bore.

THE AVEY DRILLING MACHINE CO., CINCINNATI 1, OHIO

drilling, tapping, production machines

and losing ground?

Avey





**Hamilton
announces...**

exclusive double lube protection for new top drive full eccentric presses

New from Hamilton . . . two major mechanical press developments in one . . . a complete new line of welded steel, top drive, full eccentric presses from 300 to 4000 tons . . . an exclusive new double lube system protects each press for extra-long, trouble-free service and for smoother, precision performance.

Hamilton double lube is a combination of a carefully engineered pressure oil lubrication system PLUS a complete set of troughs and gravity flow channels to provide gravity lubrication. All bearings are positively lubricated even if pressure and flow switches should fail. Double lube is double insurance against lubrication failure—a major cause of costly downtime.

In addition, this line features Hamilton's new air

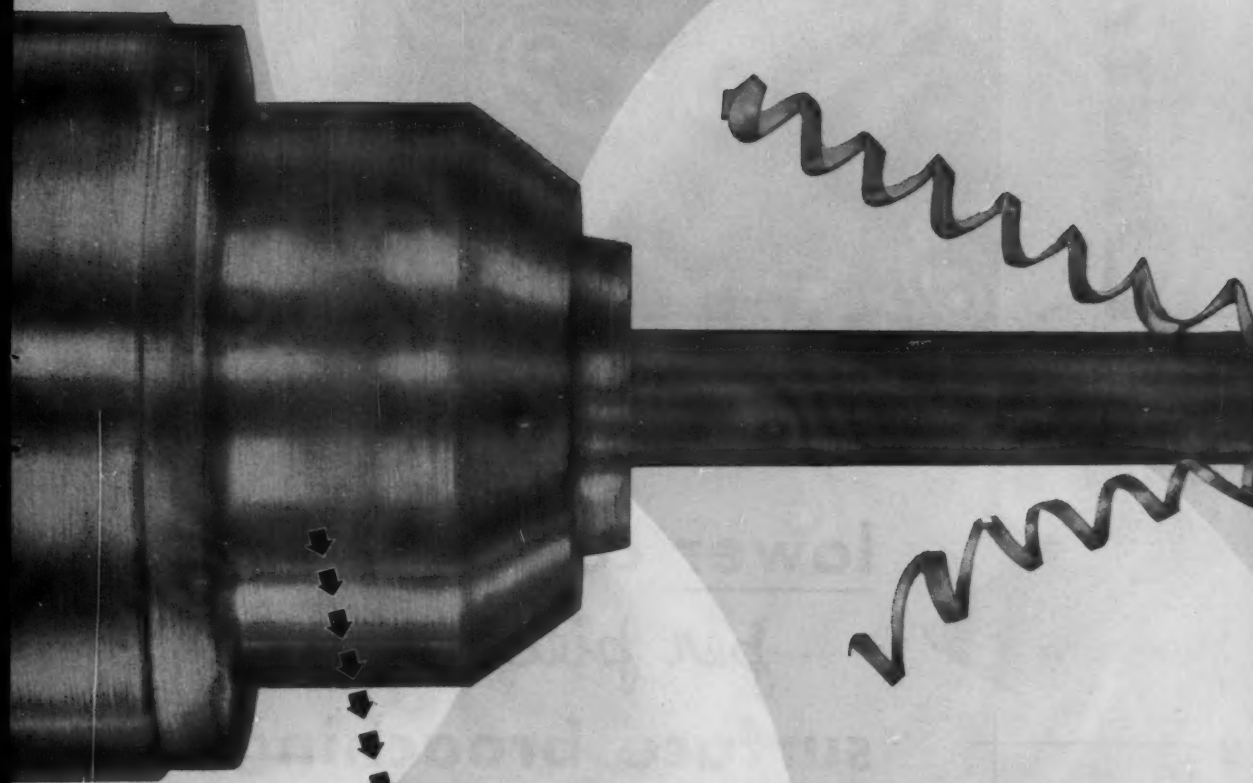
clutch, which combines all the advantages of two types . . . low inertia and mechanical interlocking.

Hamilton—pioneer of the giant automotive stamping presses—meets today's demand for higher quality, faster production, less downtime. Put this know-how to work for you! Send for the full story. Write Dept. 4419, Hamilton Division, BLH Corporation, Hamilton, Ohio.



HAMILTON DIVISION BALDWIN-LIMA-HAMILTON

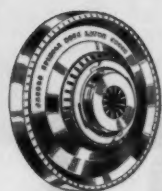
DIVISIONS: Austin-Western • Eddystone
Electronics & Instrumentation • Lima •
Hamilton • Loewy-Hydropress • Pelton
• Madsen • Standard Steel Works



100 to 1 . . .
it's a
Jacobs
CHUCK

Jacobs and your industrial supply distributor are ready to deliver the chucks you need and the service you deserve. First in chucks . . . first in service.

THE JACOBS MANUFACTURING COMPANY • WEST HARTFORD, CONN.



The Jacobs Model 91 Spindle Nose Collet Chuck for tool room and engine lathes.



The Jacobs Rubber-Flex® Top Chuck for tapping heads and impact tools.



The Jacobs Plain Bearing Chuck for drill presses, portable electric and air tools.



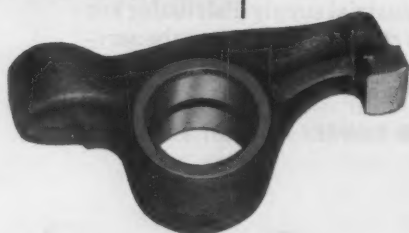
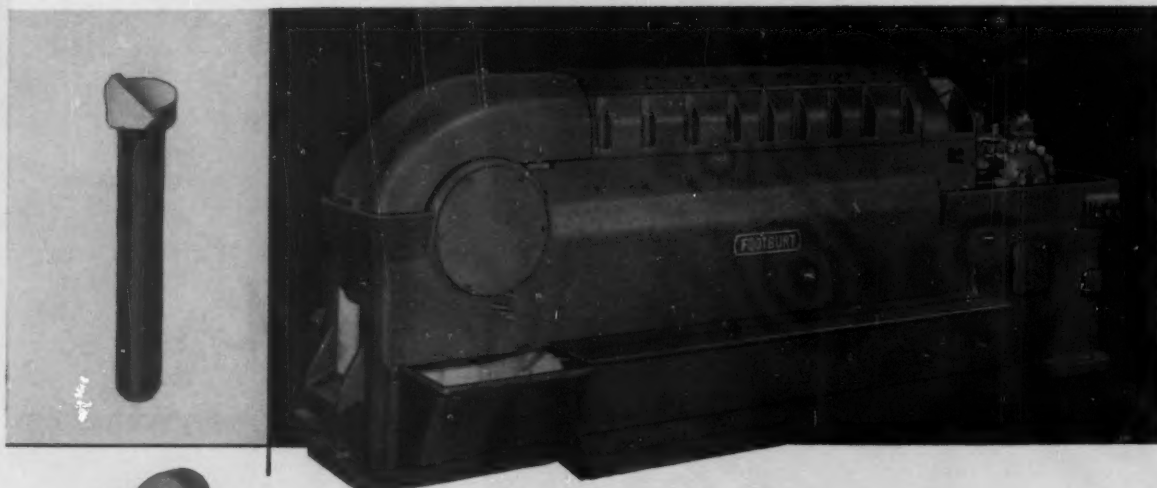
The Jacobs Ball Bearing Super Chuck for heavy duty and precision industrial use.



The Jacobs Model 96 Collet Chuck for grinding machines, millers and jig-borers.



The Jacobs Impact Keyless Chuck especially designed for the aircraft industry.



lower cost
per piece with
surface broaching
of small parts

■ In many plants where large quantities of duplicate metal parts are being machined, substantial savings are being made through the adoption of surface broaching. Production is exceptionally high, close tolerances are maintained, and tool maintenance costs are much lower than with ordinary methods. Foote-Burt engineers, pioneers in this advanced machining method, have had a wide experience in applying surface broaching, in many fields.

THE FOOTE-BURT COMPANY


Cleveland 8, Ohio

Detroit Office: General Motors Building


Engineered for production

FOOTE-BURT

PIONEERS IN SURFACE BROACHING



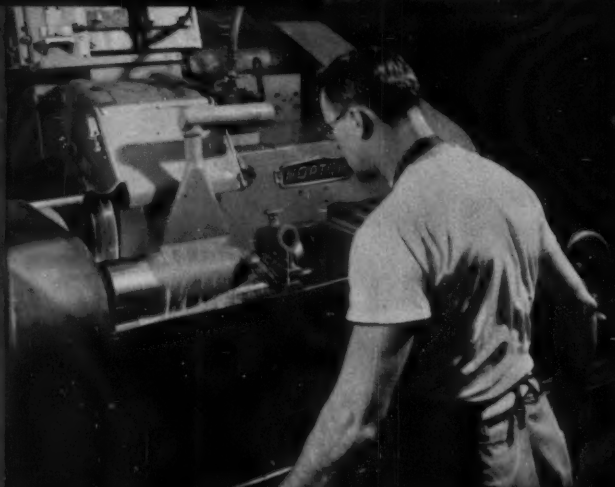
NORTON leads the world
in abrasives



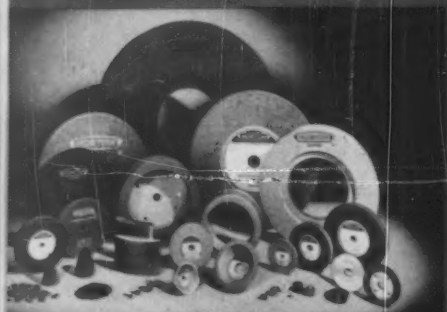
Making better products . . . to make your products better

**NORTON BRINGS THE
"TOUCH OF GOLD"
TO GRINDING JOBS
THE WORLD OVER**

THE TRUE "TOUCH OF GOLD" in grinding can happen only when the grinding wheel — or other abrasive product — is doing the best possible job. That is, when it is saving the most time and money — adding the greatest value to the product being ground — and boosting grinding profits to the maximum. These are the benefits built into all Norton abrasives.



And here are some of the ways in which Norton makes sure you can add the "Touch of Gold" to every grinding job you do . . .



THE BROADEST LINE. Norton offers you the widest choice of abrasive products — available in hundreds of thousands of different grinding combinations, so you will get exactly what you need for best production at lowest cost.



EACH NORTON PRODUCT is manufactured to strictest quality control standards. And each is backed by research and development that have produced the greatest number of abrasive advancements in the field. For example 32 ALUNDUM® abrasive, unequalled for fast, cool cutting action on today's steels . . . G Bond, most efficient vitrified bond ever developed . . . and VORZITE boron carbide, hardest material made by man on a commercial production basis.



YOUR NORTON DISTRIBUTOR is ready to help you on any grinding problem. His factory-trained specialist will see that you get exactly the right wheel for each job. And your Norton Abrasive Engineer is always available for expert technical consultation. Take advantage of these application aids to better, more profitable grinding.

NORTON WAREHOUSES



PITTSBURGH Port of Palletized Stock for Steel Mills



CLEVELAND



CHICAGO



PHILADELPHIA



DETROIT

FAST SERVICE FROM FULL STOCKS. Norton Distributors, in 208 cities in the U.S.A., maintain stocks fully adequate to the needs of each area. They, in turn are backed-up by warehouse stocks in five major industrial areas, and by the vast stocks in the mile-long Worcester plant. Serving customers abroad are 11 Norton plants and scores of Distributors.

*Trade Mark Reg. U. S. Pat. Off. and Foreign Countries

NORTON
ABRASIVES

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to make your products better*

NORTON PRODUCTS: Abrasives • Grinding Wheels
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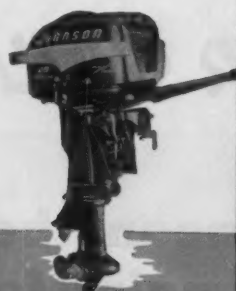
Distributors in all industrial areas — see your classified telephone directory

BEHR-MANNING, Troy, N. Y. is a division of Norton Company

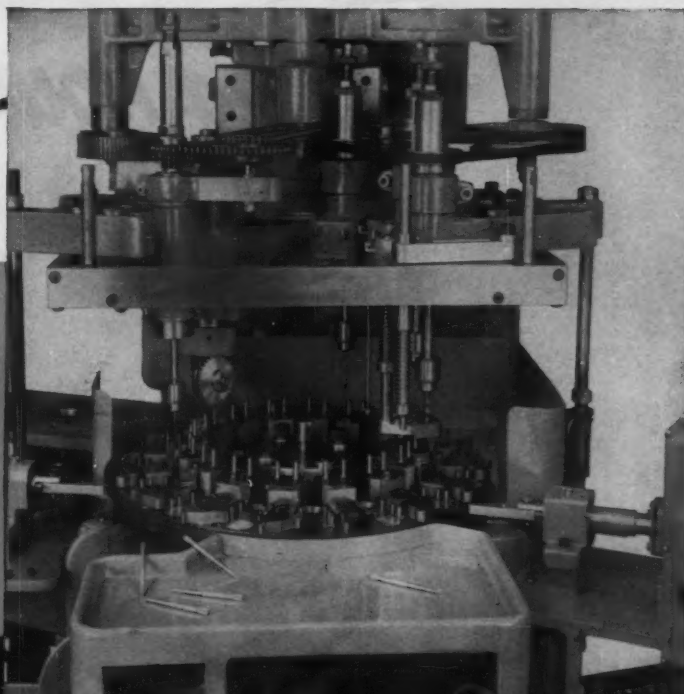
Export: NORTON BEHR-MANNING OVERSEAS INC., Worcester, Massachusetts

Bodine

CASE HISTORY NO. 39



PROCESSING 3 PARTS 22 VARIATIONS FOR JOHNSON "SEA-HORSE" OUTBOARD MOTOR



1. NEEDLE VALVE:

Drill hole $1\frac{1}{8}$ " deep in top end. Countersink hole to $\frac{7}{32}$ " dia. 25° included angle. Mill .035" slot $1\frac{1}{8}$ " deep down center axis of hole, vertical milling spindle. Tap hole 6-32 NG-2 to $\frac{3}{16}$ " deep. Production 750 pieces per hour. In 14 lengths... $2\frac{1}{2}$ " to $4\frac{1}{2}$ ".



2. HIGH SPEED NOZZLE:

(Vertical milling spindle removed; horizontal spindle substituted.) Seven different nozzles, 1 to 3 holes of different diameters produced. Meter holes drilled through one side and a hole $1\frac{1}{8}$ " deep in small end of nozzle. Mill $\frac{1}{8}$ " slot, $\frac{1}{8}$ " deep in top end of nozzle with horizontal milling spindle. Production, 1500 pieces per hour.



3. FLOAT VALVE SEAT:

Processed with 4 variations in the inside dia. of seat. Two I.D. diameters combination reamed to .004" (T.I.R.) concentricity with clamping dia. Valve seat rough and finish faced, depth tolerance .005". Mill $\frac{3}{16}$ " slot, $\frac{1}{16}$ " deep (horizontal spindle). Production, 1100 pieces per hour.

The three jobs detailed above are produced on the Bodine standard Model No. 41-20... by means of a changeover of two horizontal indexing dials and sets of spacers for the variety of lengths of the needle valves.

All parts are hand fed, automatically positioned and clamped. The needle valves are automatically unclamped and unloaded by hand to protect the needle points. Other products are automatically ejected.

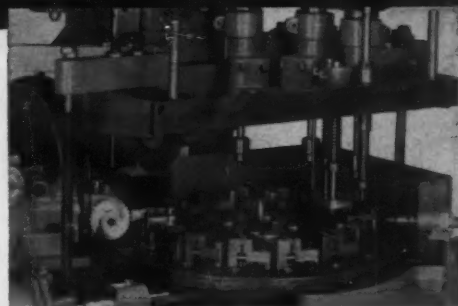
The installation of the vertical (photo above) and horizontal (photo at right) milling spindles with the other tools saved an extra handling on all three jobs.

All operations are held to close tolerances. Bodine offers 4 standard-size models which will perform Drilling, Tapping, Milling and Screw Inserting. Operations may be combined as required... or machines may be tooled for assembly only, with hopper feed and transfer mechanism for completely automatic production.

Bodine automatics will give you tomorrow's production today. Send us your tough problems... we may solve them to your competitive advantage.


Write Dept. M-11 for the Bodine Case History Brochure.

**"You Can't Meet Tomorrow's Competition
with Yesterday's Machine Tools"**



THE
Bodine
CORPORATION
BRIDGEPORT CONNECTICUT

AUTOMATIC DIAL TYPE DRILLING, MILLING,
TAPPING AND SCREW INSERTING MACHINES



24 HOUR SUNLIGHT

means better paint for industry

Developing *the right paint for your product or plant* is only the first step in the complete Lowe Brothers Technical Service.

Highly skilled technicians also perfect production techniques and supervise their control to guarantee that every mix of your formula is exactly the same and meets your rigid specifications.

To control this production the very best testing equipment, such as the standard-light condition unit shown here, are utilized at every step during manufacture. As many as 89 separate production tests are standard for some paints.

This combination of technical "know how" and "production ability" assures you of the right paint for the best job every time. For this complete service call in your finishing specialist at LOWE BROTHERS, 434 East Third Street, Dayton 2, Ohio.

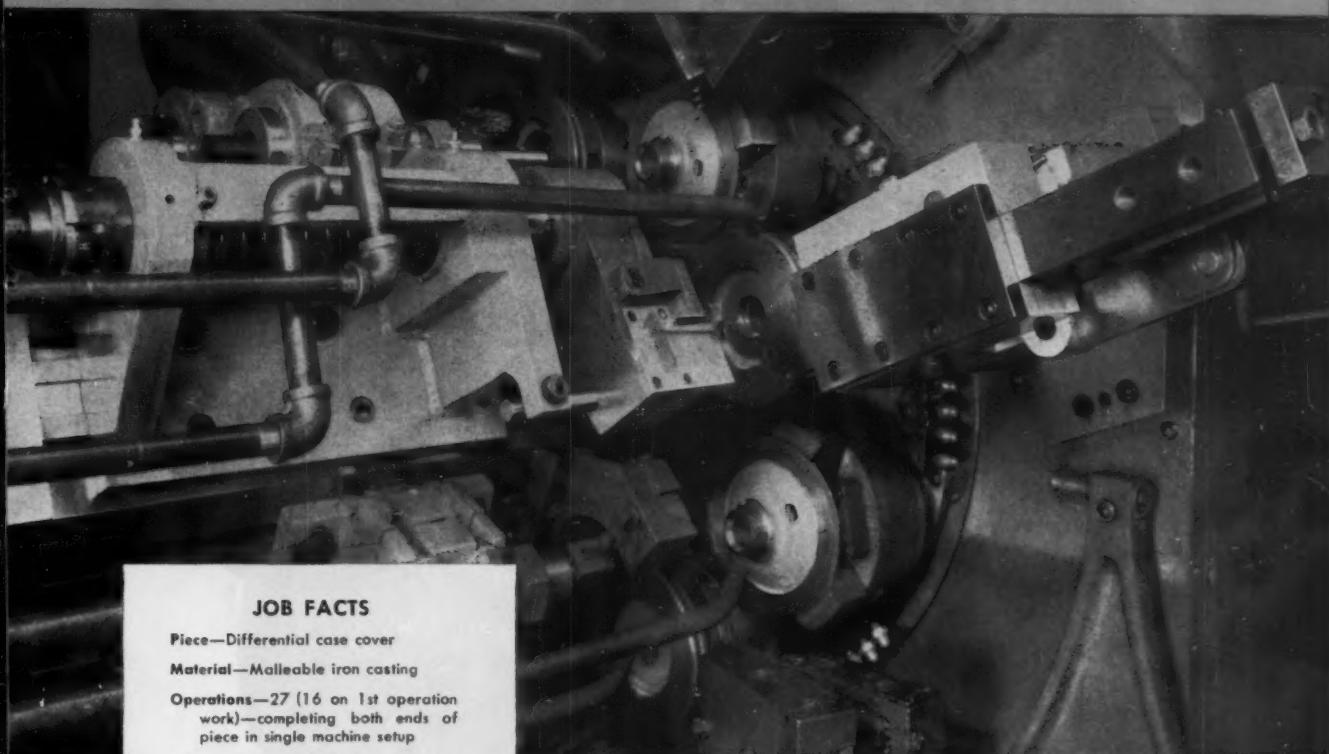
To guarantee exact duplication of color, a sample of each batch is checked against your required color standard under controlled light conditions. Sunrise and high noon light conditions can be produced by the lamp shown above, day or night. Further checks on color employ an electronic color difference meter.

LOWE BROTHERS

INDUSTRIAL FINISHES

Quality unsurpassed since 1870

Acme-Gridley



JOB FACTS

Piece—Differential case cover

Material—Malleable iron casting

Operations—27 (16 on 1st operation work)—completing both ends of piece in single machine setup

Machine Time—30 seconds

Machine—8"RPA-8 Acme-Gridley
Chuck arranged for double indexing



Write today for your free copy of 16-page illustrated bulletin CM-31A that shows and describes how Acme-Gridley 4, 6 and 8 spindle chucking automatics are designed to give you the maximum return on your investment.

**minimizes the importance of the decimal point ...
maintains automotive quality control**

Continuous quality control, so basic to modern automobile production, was implemented by this manufacturer when he chose Acme-Gridley multiple spindle chucking automatics to perform 27 operations on the piece shown at the left. This not only let him do more operations in a single machine setup but, because of Acme-Gridley inherent design for sustained accuracy at high speeds and feeds, gave him decimal point accuracy that remained within control limits for check lot after check lot. Thus he prevents costly production bottlenecks, reduces scrap and maintains a balanced flow of parts to final assembly points.

National Acme

THE NATIONAL ACME COMPANY, 179 EAST 131ST STREET, CLEVELAND 8, OHIO

SALES OFFICES: • Newark 2, New Jersey • Chicago 6, Illinois • Detroit 27, Michigan

THREADING COSTS reduced to \$0.00003 per piece with new ACME-FETTE Thread Rolling Head. Details on following Page → → →

Acme-FETTE

Cuts threading costs to
\$0.00003
per piece

On an automotive part that required millions of *duplicate* pieces, one manufacturer found that the application of Acme-Fette thread rolling heads enabled him to:

1. Get required production with 9 Acme-Gridley bar automatics instead of 14.
2. Secure better threading results with rolled threads which provided smoother, tougher threaded pieces.
3. Show a unit threading cost of 3 one-thousandths of a cent.
4. Reduce total cost per piece more than 33 1/4% while producing in excess of 35,000,000 pieces.

Why not check Acme-Fette advantages on your threading jobs?

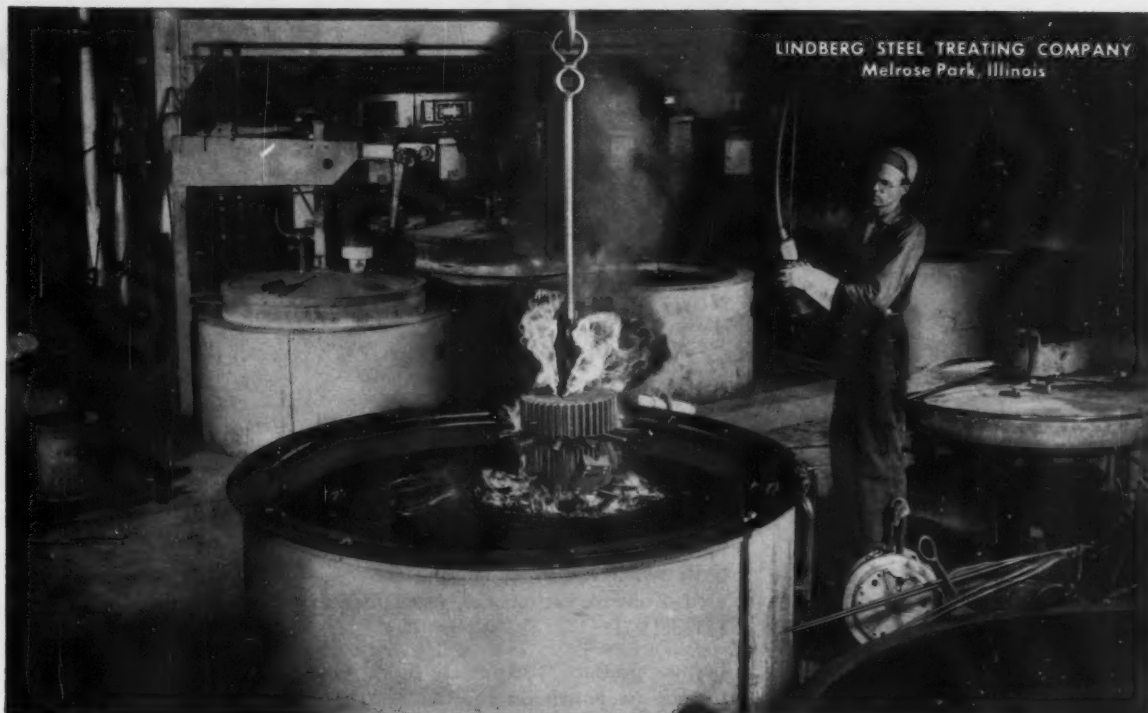


New Acme-Fette Type N self-opening thread rolling heads are used with either rotating or non-rotating spindles. They let you complete threaded jobs on your present turning equipment without rehandling — roll threads 5 times faster than thread cutting methods (and with no chip problem).

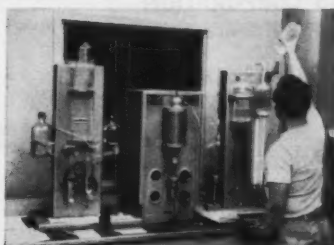
National Acme

THE NATIONAL ACME COMPANY, 179 EAST 131ST STREET, CLEVELAND 8, OHIO

SALES OFFICES: • Newark 2, New Jersey • Chicago 6, Illinois • Detroit 27, Michigan



For machine shop tolerances— Lindberg uses Cities Service Quenching Oil



Lindberg's Lab stringently tests treated metals. Dimensional changes from poor quenching oil would quickly show up here. But Cities Service Quenching Oil cools metal with no significant dimensional change.



Some of Lindberg's Furnaces. Here, they heat-treat all kinds of steel products . . . bolts, washers, gear blanks, saw blade segments, etc. Steel for bars of Illinois State Penitentiary was one of their first jobs.

At Lindberg Steel Treating Company a routine order might include a dozen shafts, stamping and forming dies, jigs and fixtures and even production parts. But though the products might differ, most would carry the same stipulation—heat treat with very low dimensional change.

To some heat treating operations this might present a problem, but not to Lindberg. By the use of Cities Service Quenching Oil, they're able to cool their steel with no significant changes in dimension.

"In addition," say Lindberg metallurgists, "we like Cities Service Quenching Oil because it has high flash point, consistent viscosity, excellent oxidation resistance, and a stable cooling rate."

Anyone looking for a better quenching oil would do well to try this superior Cities Service oil. For further information, talk with your local Cities Service Lubrication Engineer. Or write: Cities Service Oil Company, Sixty Wall Tower, New York 5, N. Y.

CITIES SERVICE

QUALITY PETROLEUM PRODUCTS

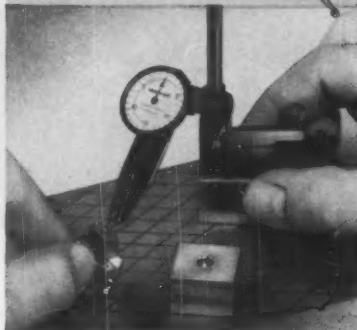
The World's Most Imitated **FEDERAL**

TESTMASTER

TRADE MARK REG. U. S. PAT. OFF.



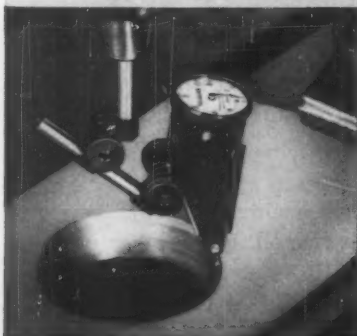
Regular Type — Adaptable to all tool posts, height and surface gages, etc.



Perpendicular Type for use on jig borers, in deep holes, etc.



Non-Magnetic Type for use on magnetic chucks, parallels and other magnetic fixtures.



Dovetail Slides and Universal Clamp make Testmaster easiest to set and insure rigid support in any position. Dial rotates for quick setting.



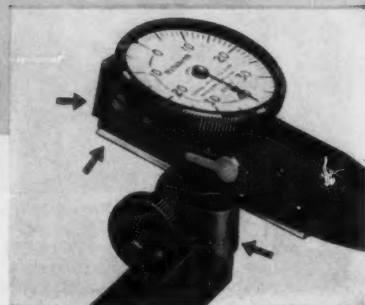
Crown Gear Movement. Reduces friction and inertia to a minimum insuring great accuracy. Gear teeth hobbled for accuracy.



Jewel Bearings — Vital bearings are jeweled to reduce friction and insure continued accuracy.



Index Point. Interchangeable. Ratchet design permits hard Chrome Plated Point to be reversed or set positively at any angle within 180° arc.



Copied in Foreign Countries and by nearly a dozen companies in the United States, it still offers more than any other!

The Federal Testmaster, though extensively imitated, has never been equalled.

The crown gear movement which is original with these Indicators makes it possible to build-in the exceptionally high accuracy and sensitivity which are so valuable to users. Two different gear ratios are used — one for each model, graduated in .001" (Model 1) and .0001" (Model 2).

Contact pressure is extremely light. Contact points are ratchet-held for positive positioning.

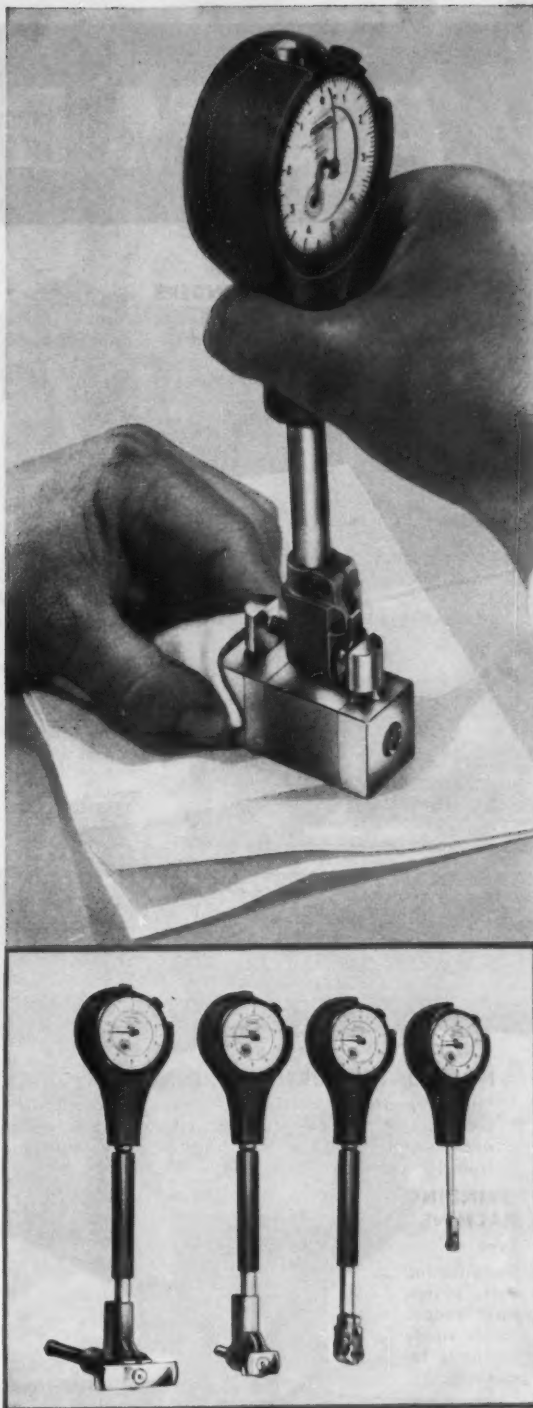
The Testmaster is simple to use, without complicated adapters that are not only cumbersome but also cause inaccuracies due to friction, lost motion and inertia. Ruggedly built for production inspection and exceptionally adaptable to the many tests required in general machine shop and tool room operations, the Testmaster has a thousand uses. Ask for illustrated bulletin.

FEDERAL PRODUCTS CORPORATION
61111 Eddy Street • Providence 1, R. I.

Ask **FEDERAL** First

FOR RECOMMENDATIONS IN MODERN GAGES . . .

Dial Indicating, Air, Electric, or Electronic—for Inspecting, Measuring, Sorting, or Automation Gaging



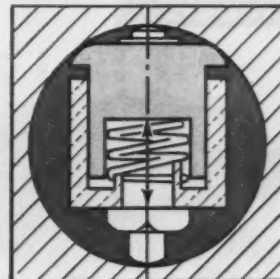
Four gages inspect all diameters from $\frac{1}{2}$ " to 8"

YOU SET IT DIRECTLY TO GAGE BLOCKS or with a micrometer . . .

**Precise Centralization
is Built-in**

MODEL 1250 SERIES BORE GAGE

Positive centralization. Single plunger eliminates off-center location, assures precise alignment of centralizers and sensitive contact.



You can set this gage to gage blocks or micrometers with perfect assurance that when you place the gage in the hole the contacts will locate precisely on the true diameter.

Instead of using two separate centralizing plungers which might respond unequally to a common source of pressure, thereby making centralization inaccurate, the 1250 Series Bore Gages have a single, large, spherically radiused plunger which contacts the circumference of the hole at two points. The generous bearing surfaces assure precise movement of the plunger so that pressure is exerted equally at each point of contact, causing the gaging head to seat with greater accuracy on the true diameter of the hole.

At time of assembly, the sensitive and reference contacts of each gage are radiused precisely concentric with the plunger. This provides much greater accuracy than can be actually obtained by attempting to align a sensitive contact with two separate plungers. Even when the gage is unintentionally cocked laterally, it still holds its accurate centralization. Write for complete details.

FEDERAL PRODUCTS CORPORATION
61111 Eddy Street • Providence 1, R. I.

**FEDERAL'S SOLUTION
TO THE COST OF GAGING:**
Impartial Gage Selection
Engineering Follow-Through
Everything in Gages

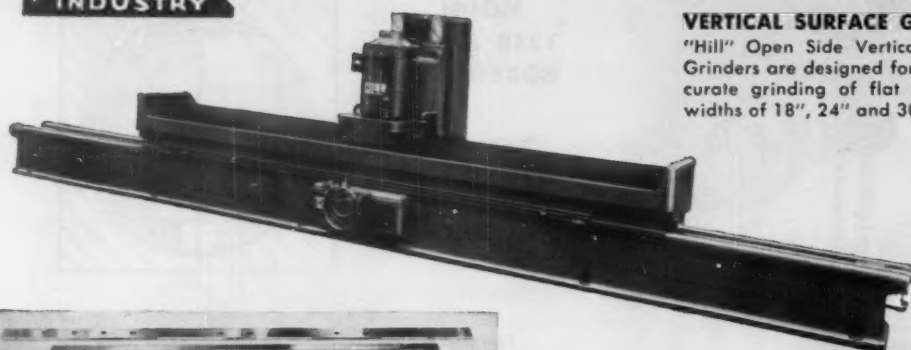
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FOR RECOMMENDATIONS IN MODERN GAGES . . .

Dial Indicating, Air, Electric, or Electronic—for Inspecting, Measuring, Sorting, or Automation Gaging

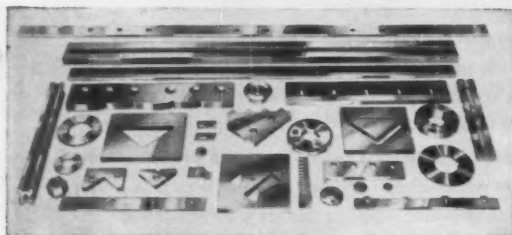


HILL ACME



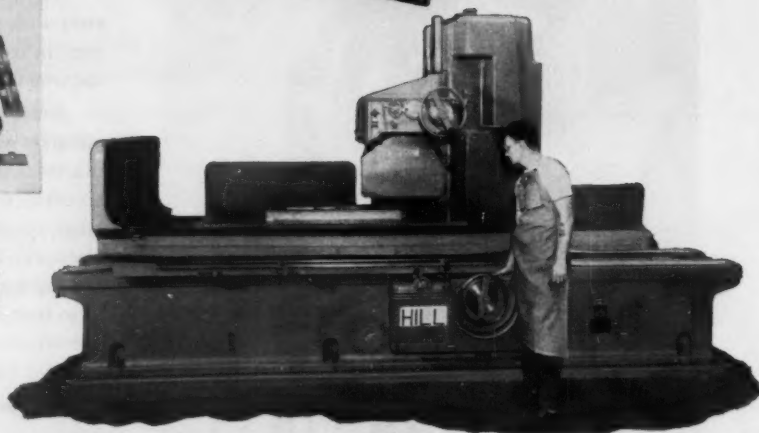
VERTICAL SURFACE GRINDERS

"Hill" Open Side Vertical Spindle Hydraulic Surface Grinders are designed for rapid stock removal and accurate grinding of flat surfaces. Furnished in table widths of 18", 24" and 30"; table lengths 60" to 240".



SHEAR KNIVES

"CLEVELAND" Knives and Shear Blades. Solid and laid steel shear blades; rotary slitting and side trimming knives; metal cutting machine knives.



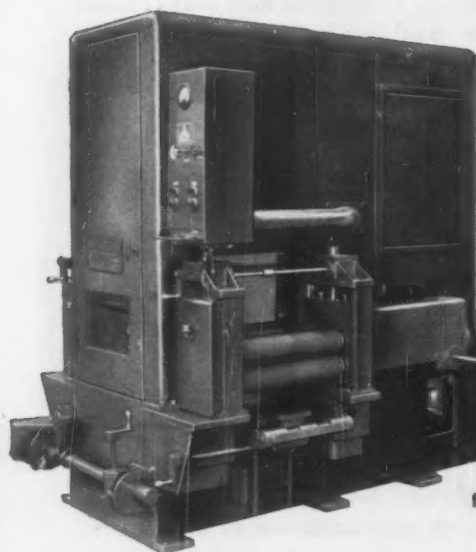
HORIZONTAL SURFACE GRINDERS

"Hill" Open Side Horizontal Spindle Hydraulic Surface Grinders for accurate grinding of flats, angles, irregular and special shaped surfaces. Furnished in table widths from 18" up to 36"; table lengths 60" to 240".

ABRASIVE BELT GRINDING & POLISHING MACHINE

(Pinch Roll Type)

For pre-finishing, conditioning and polishing sheets, plates, strips or blanked-out shapes in flat form. Used as single units or in multiple units for progressive line polishing.



The basic HILL two-roll vertical head with endless abrasive belt. Used in both the Pinch-Roll and the Hydraulic Table types.

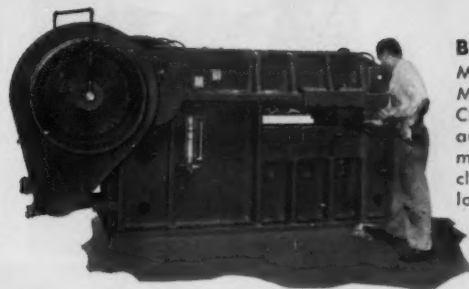


ABRASIVE BELT POLISHING MACHINE

(Hydraulic Table Type)

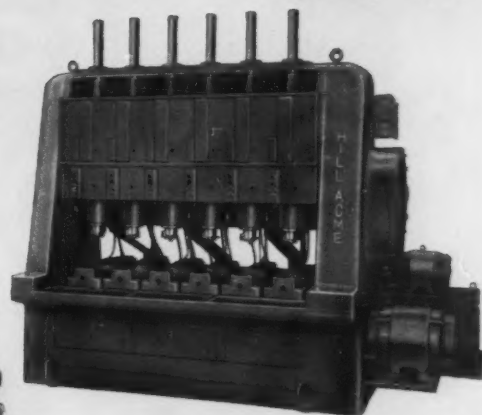
For flat polishing of sheets and plates of ferrous and non-ferrous metals. Made in a variety of table widths and lengths with fully hydraulic reciprocating table.

Tools for Industry



BAR-BILLET SHEARS

Modern, efficient design. Made in 3" to 6 1/2" sizes. Choice of hand, semi-automatic or fully automatic feed. Assures clean, square cuts with low maintenance.



TAPPING MACHINES

"ACME" model XC-W six spindle Coupling Tapper. Built in 1" capacity and larger, in 6 or 8 spindle. Can be adapted as a nut tapper.

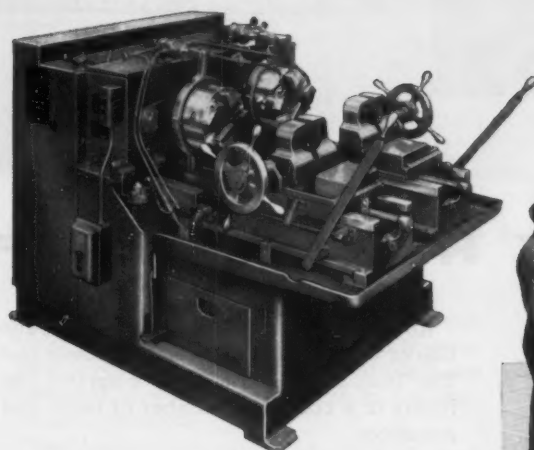
ALLIGATOR SHEARS

"CANTON" Alligator Shears are the most rugged, powerful and trouble free shears ever built for processing scrap. Modern design has produced a stronger shear, with fewer parts, and positive lubrication. Made in a full range of sizes to meet every condition.



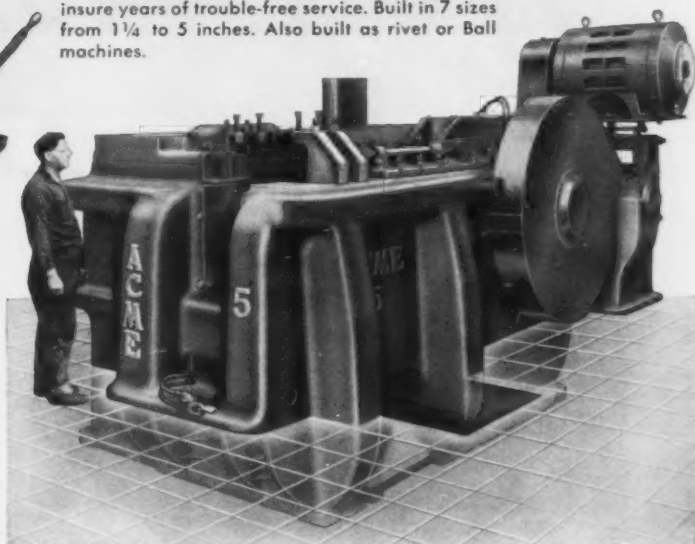
FORGING MACHINES

"ACME" XN Forging Machines produce accurate, quality forgings for long uninterrupted periods. Massive construction and simplicity of operation insure years of trouble-free service. Built in 7 sizes from 1 1/4 to 5 inches. Also built as rivet or Ball machines.



THREADING MACHINES

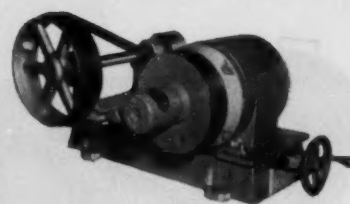
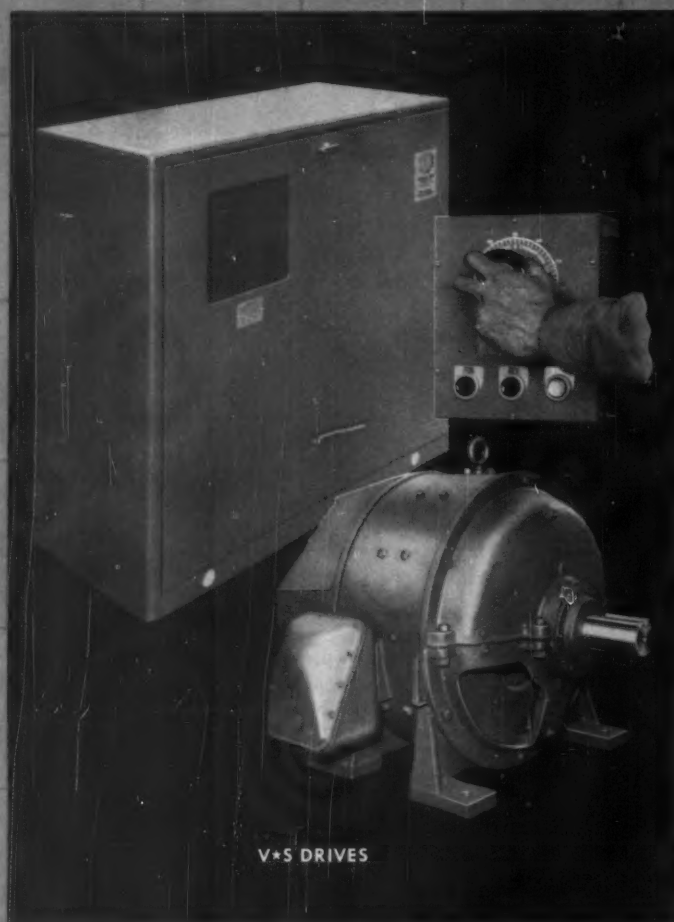
"ACME" XLA Single and Double Spindle Threading Machines are equipped with patented tangent or hob type die head which assures economical, accurate, high speed production. Furnished in sizes from 1" to 3 1/2" capacity.



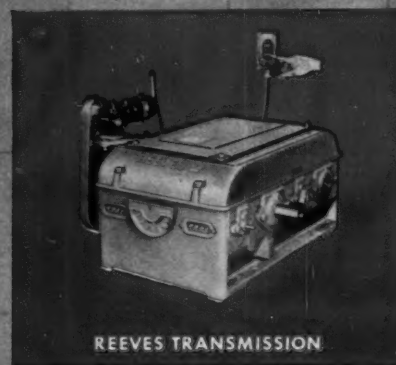
THE HILL ACME COMPANY

1201 WEST 65th STREET • • • CLEVELAND 2, OHIO

"HILL" GRINDING & POLISHING MACHINES • HYDRAULIC SURFACE GRINDERS • ALSO MANUFACTURERS OF "ACME" FORGING
THREADING • TAPPING MACHINES • "CANTON" ALLIGATOR SHEARS • BILLET SHEARS • "CLEVELAND" KNIVES • SHEAR BLADES



REEVES MOTOPULLEY



REEVES TRANSMISSION

● WIDENING THE HORIZONS OF



Automation is the key to greater production of more goods and services at lower cost. The Tools of Automation can be applied profitably in a countless number of individual industries.

Reliance can provide you with valuable engineering assistance which can help secure the advantages of automation.

Our Tools of Automation consist of electric motors, variable-speed drives and controls.

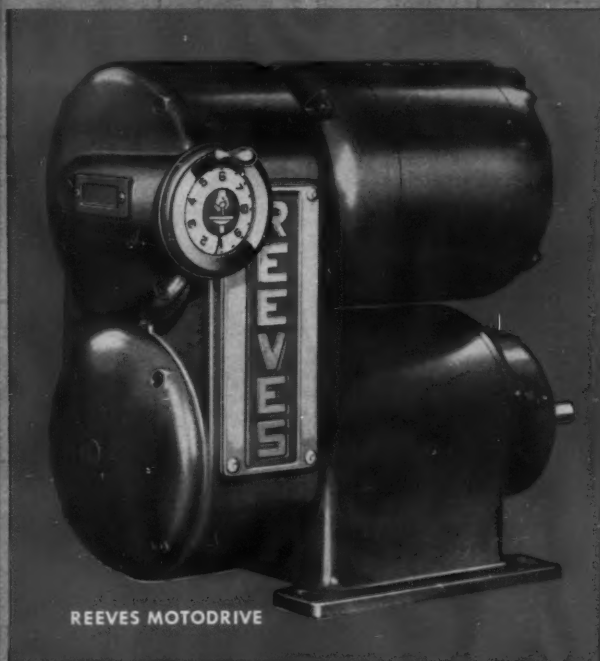
RELIANCE



TOTALLY-PROTECTED MOTORS



GEARMOTORS



REEVES MOTODRIVE



RELIANCE MOTORS ON HIGH SPEED
AUTOMATIC TRANSFER MACHINES

AUTOMATION

Application of these tools ranges from a single motor to multi-motor drives for highly complex production lines, where materials are processed into finished products in one continuous operation.

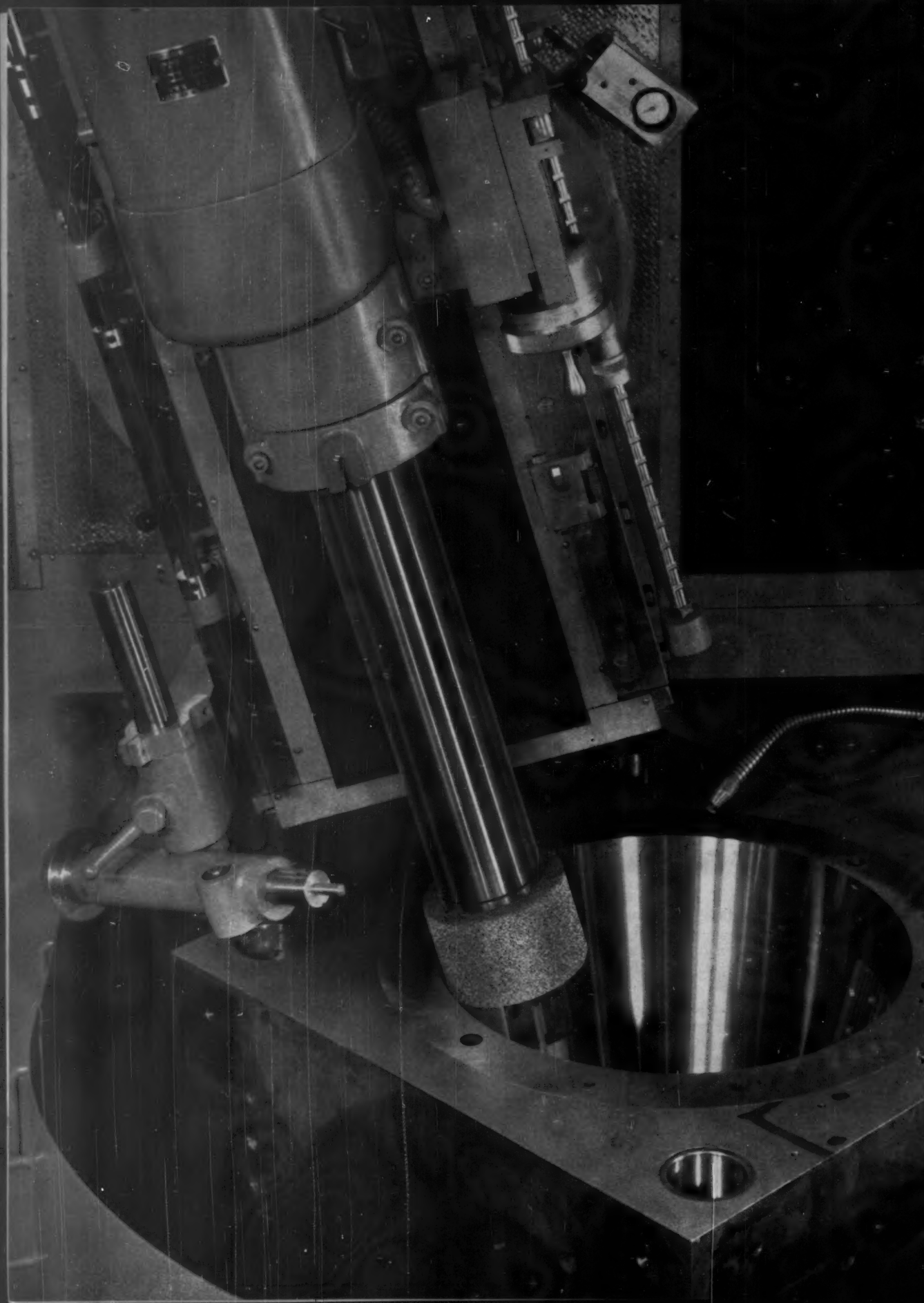
The world's largest manufacturer devoted exclusively to the production of quality motors and drives is ready to help you widen the horizons of automation in your plant.

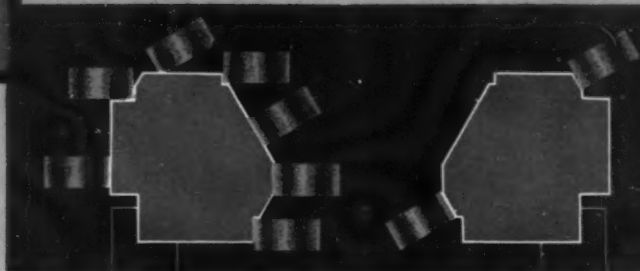
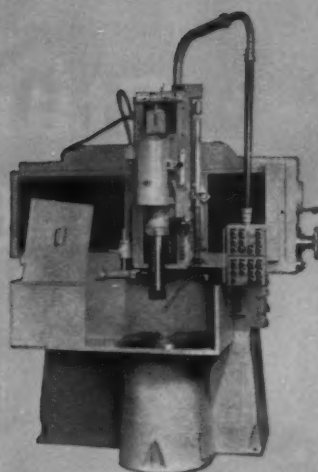
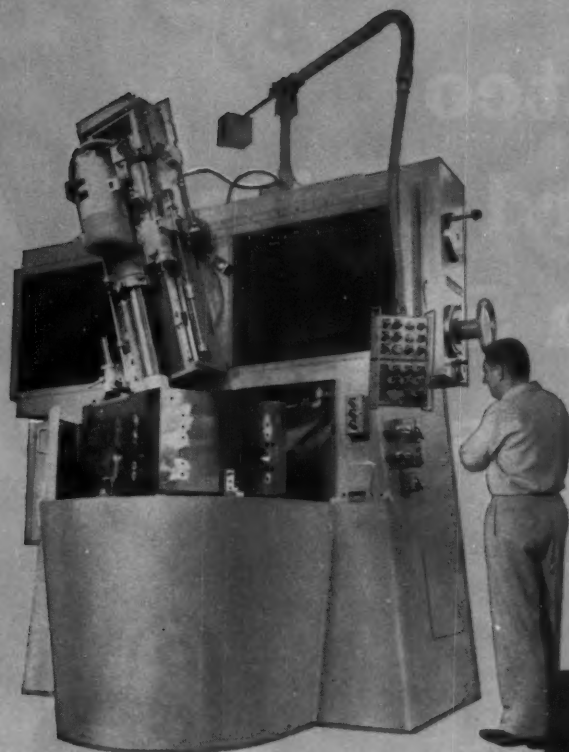
Bulletin No. A-1555-B gives further details.

A-1519

**ELECTRIC AND
ENGINEERING CO.**

DEPT. 311A, CLEVELAND 10, OHIO
Canadian Division: Welland, Ontario • Reeves Division: Columbus, Indiana
Sales Offices and Distributors in Principal Cities





one setup: **nine** jobs

As flexible, as responsive as a dentist's drill, a Springfield Vertical Universal Grinder can reach around and into a workpiece to do nine different jobs on one chucking.

If you make a pipeline valve, a mold, a bearing race—requiring micro-inch finish on any or all the faces shown in the diagram—at whatever angle—look into Springfield. These grinders cut down the number of set-ups, frequently eliminate hand-lapping, operate with fewer work-holding devices. And, as a bonus, on jobs calling for extreme concentricity, one angle setting of the Springfield head grinds both faces of mating parts.

All three models readily adaptable to special problems.

Vertical Universal Grinders: swings 18", 24" and 42".

Lathes: Engine and tool room, contouring and reproducing—swings 14" to 32".

The Springfield Machine Tool Company
Springfield, Ohio

66TH YEAR OF BUILDING IDEAS INTO MACHINE TOOLS

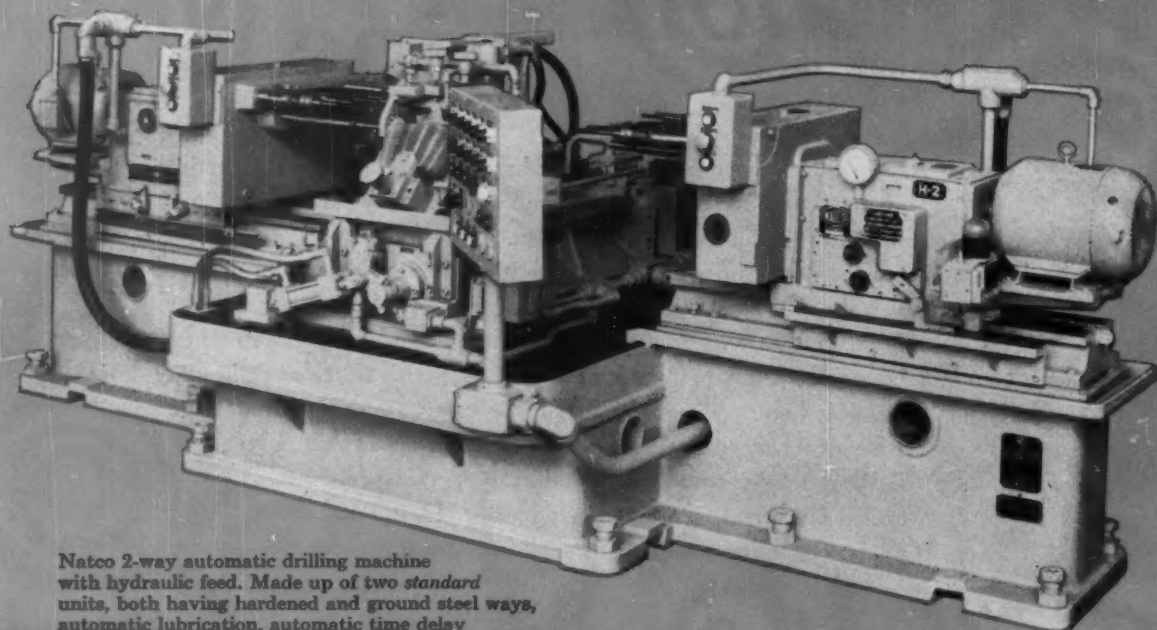
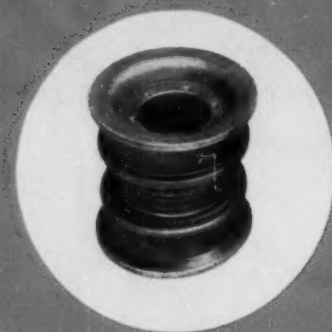
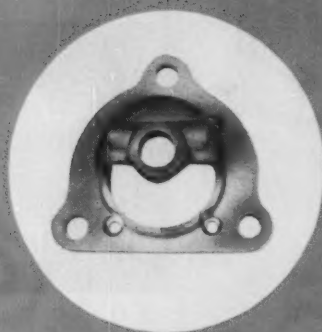
SPRINGFIELD

Natco

Standard Units

Perform Special

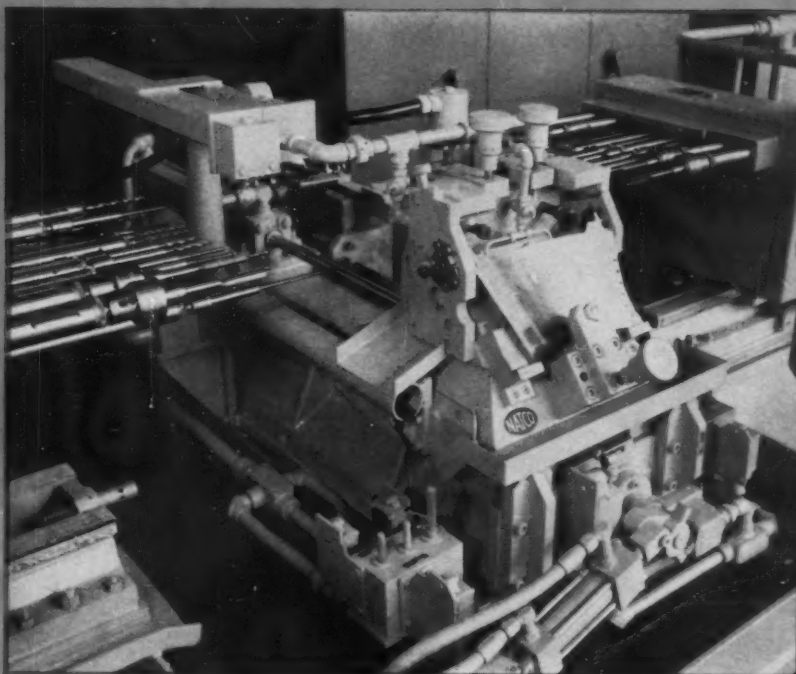
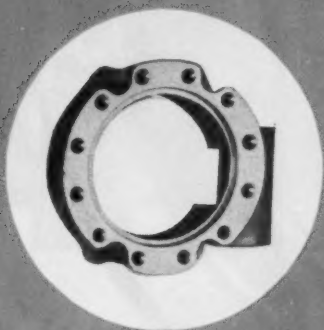
Jobs



Natco 2-way automatic drilling machine with hydraulic feed. Made up of two standard units, both having hardened and ground steel ways, automatic lubrication, automatic time delay and positive stop.

Many *special* jobs can become routine with Natco's *standard* unit design. Take these parts, for instance. Unique parts presenting unique problems. Natco solved them by using *standard* horizontal, self-contained Holeunits with automatic fixtures. Varied operations are performed—production to meet customer's requirements.

Natco's use of *standard* units can mean quicker delivery and lower price to you. Call a Natco Field Engineer to determine whether Natco's *standard* unit design can solve your "special" problems.



Ask for information about the PAYD (Pay-As-You-Depreciate) Finance Plan.

NATIONAL AUTOMATIC TOOL COMPANY, INC.

Richmond, Indiana

Multiple-spindle drilling, boring,
facing and tapping machines.
Special machines for automatic
production.

Call Natco offices in Chicago, Detroit, Buffalo, New York, Boston,
Philadelphia, Cleveland and Los Angeles; distributors in other cities.





American Tool Works Co.

smooth operator...

A hole is a hole is a hole—but American Tool's 32-speed Hole Wizard Radial Drill makes them with the speed and consistent accuracy that precision production demands.

And Federal XLS Ball Bearings keep the vertical shifting mechanism functioning smoothly.

tough customer...

The powerful impact action of this Chicago Pneumatic Wrench makes child's play out of tightening and loosening the huskiest nuts and bolts. It pounds away from day to day with no sign of fatigue. Here, too, Federal Ball Bearings can "take it".

Chicago Pneumatic

so much of industry turns on FEDERAL ball bearings

Dependability is a proud word, especially when you apply it to machines. And wherever you find dependable machines—in home, office or factory—you're almost sure to find Federal Ball Bearings making their vital contribution toward smooth, trouble-free performance. 12,000 sizes to solve your anti-friction problems. Hundreds of types. Produced by a 50-year-old manufacturer of ball bearings exclusively.

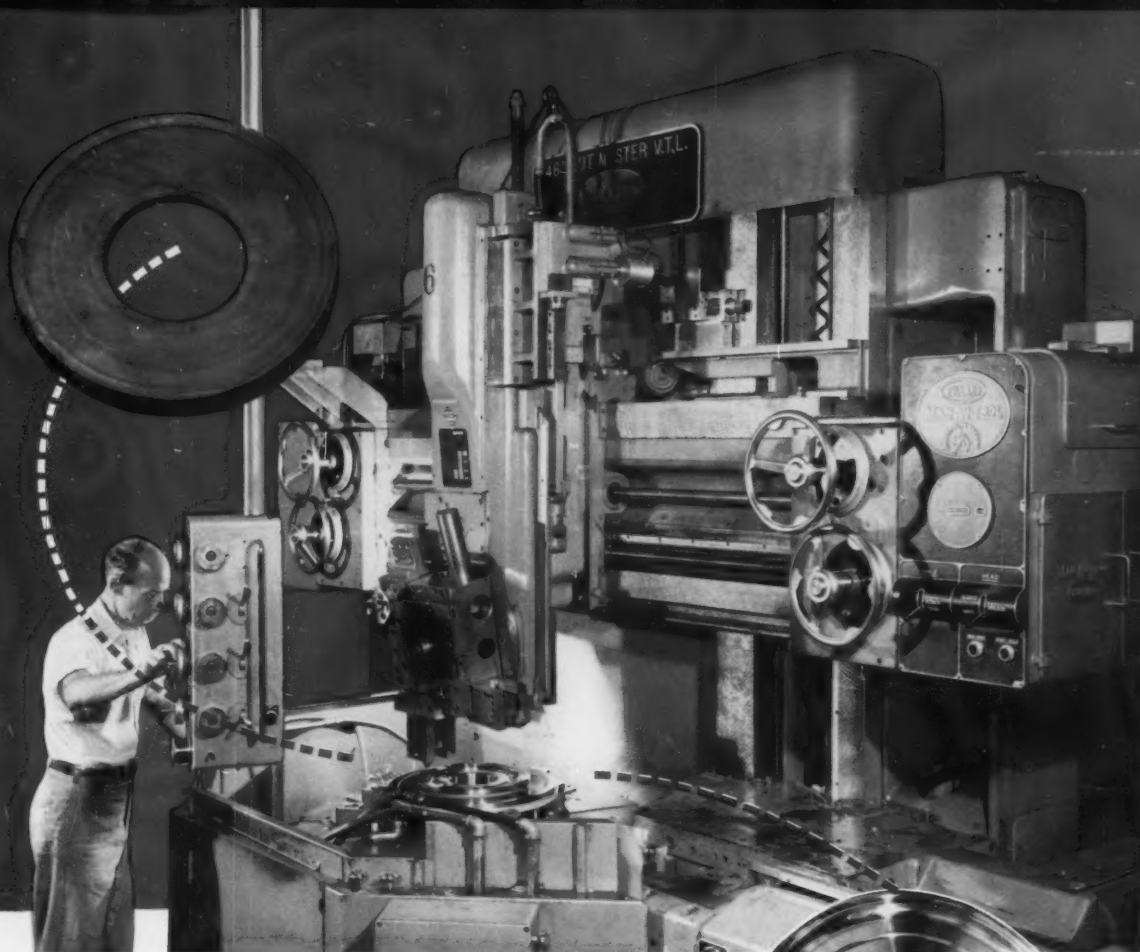
When Federal Ball Bearings are part of so many things you *use*, shouldn't they be part of the things you *make*?

THE FEDERAL BEARINGS CO., INC. • POUGHKEEPSIE, N. Y.

New! Ball bearing and engineering data! 175 pages full in FEDERAL'S CATALOG! To get your copy, just write us.



One of America's Largest Ball Bearing Manufacturers



|| To produce quality parts in quantity . . .

Nothing beats Man·Au·Trol ||

This statement by Mr. W. Mason Williams, Manufacturing Manager of the Jet Division, Thompson Products Inc., Cleveland, Ohio, is based on ten years of experience with Man-Au-Trol.

"If it hadn't been for Man-Au-Trol" Mr. Williams continues, "we would still be turning out aircraft engine components on manually-operated machines. Man-Au-Trol, particularly when tooled with better cutting tools, has enabled us to turn out at least five times as many compressor disc and turbine discs per shift as we produced on hand-operated equipment."

You, too, can apply to your machining problems the many advantages offered by Man-Au-Trol, Model 75 — just call your nearest Bullard Sales Office, Distributor or write for catalog to



THE **BULLARD** COMPANY

BRIDGEPORT 9, CONNECTICUT

It's easy to
CUT WELDING COSTS

when you use a High-Speed

LINDE SWM-2
Trade-Mark

Portable Sigma Welder

Your welding department can easily make high-speed, low-cost fusion welds in aluminum, stainless steel, high temperature alloys, copper, carbon steel, and other metals with the LINDE SWM-2 Portable Sigma Welder. The LINDE SWM-2 is a complete control unit for manual sigma (Shielded Inert Gas Metal Arc) welding operations. It mechanically feeds welding wire from a coil into the weld area at a steady precontrolled rate and supplies a regulated quantity of argon to shield the weld from contamination by the atmosphere. No flux is used. In most cases the smooth, clean sigma welds need no post-welding treatment.

SIMPLIFIED AUTOMATIC OPERATION


The operator merely presses the trigger of the pistol type torch to energize the control circuit and start the flow of water coolant and argon gas. When an arc is struck by touching the consumable electrode to the workpiece, the wire feed automatically begins.

NEW CONSTANT POTENTIAL POWER SUPPLIES CAN BE USED

Either ordinary or constant potential DC power supplies can be used with a LINDE SWM-2. In constant potential welding arc voltages are preselected and held with outstanding consistency which permits positive starts and high-speed welds on thin metals.

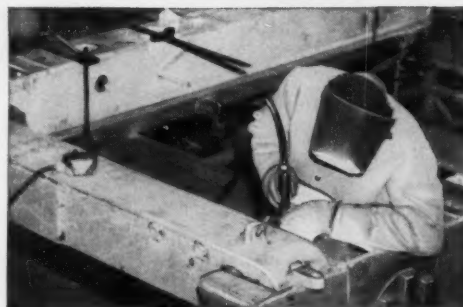
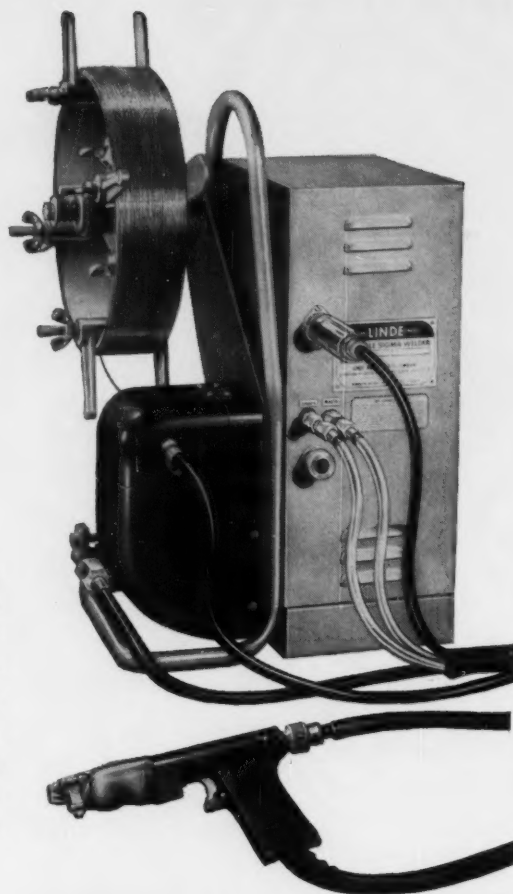
Call your nearest LINDE office today for more information on how you can cut production welding costs with the LINDE SWM-2 Sigma (Shielded Inert Gas Metal Arc) Welder. Or write for your free LINDE SWM-2 catalog.

Linde Air Products Company
A Division of Union Carbide and Carbon Corporation

30 East 42nd Street  New York 17, N. Y.
Offices in Other Principal Cities

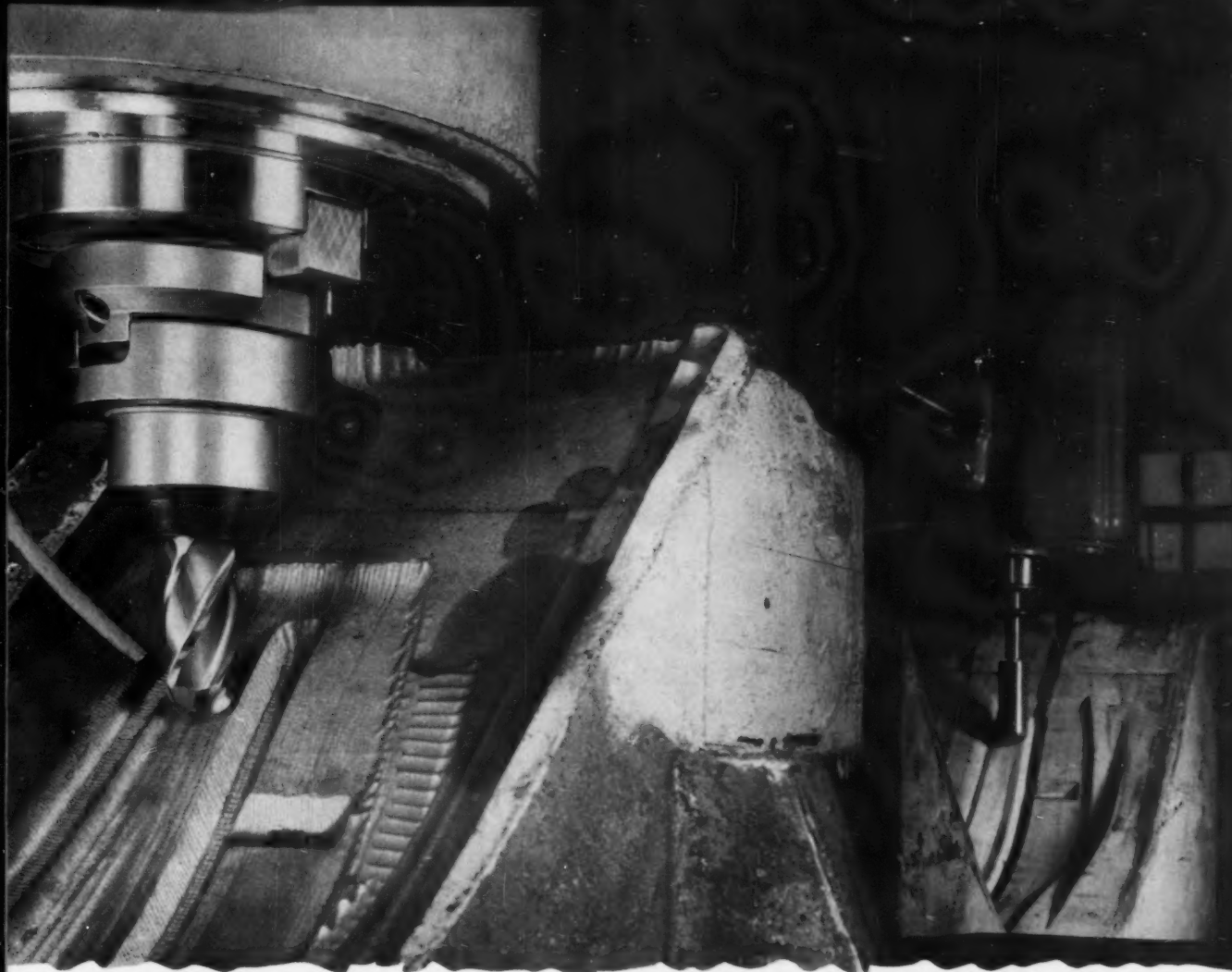
In Canada: LINDE AIR PRODUCTS COMPANY
Division of Union Carbide Canada Limited, Toronto
(formerly Dominion Oxygen Company)

The term "Linde" is a registered trade-mark of Union Carbide and Carbon Corporation.



Production jumped 300% when the Heller Engineering and Manufacturing Company, Lynwood, California changed to sigma welding to fabricate aluminum engine shipping stands. Because the sigma welds were clean and sound, post-welding treatment was practically eliminated.





EFFICIENT MILLING...in any direction!

New CLEVELAND 4-flute center cutting End Mills reduce individual end tooth shock and assure smoother cutting action, particularly in plunge milling.

The advanced design of 4-flute 500 Series High Speed End Mills is your assurance of *accuracy* and *high production* in both tracer and general purpose milling. The accurately form-ground notches and the precision ground cutting edges give you absolute uniformity and *positive chip removal*. ♦ Try these new CLEVELAND End Mills on your next job. Get all the advantages of 4-flute mills and *plunge cutting, too!* Contact our nearest Stockroom, or . . .

TELEPHONE YOUR INDUSTRIAL SUPPLY DISTRIBUTOR



BALL NOSE



SQUARE END

In both the ball nose and square end types, the rake angle is uniformly progressive from zero at dead center to blend with the hook in the cutting face of the flutes.



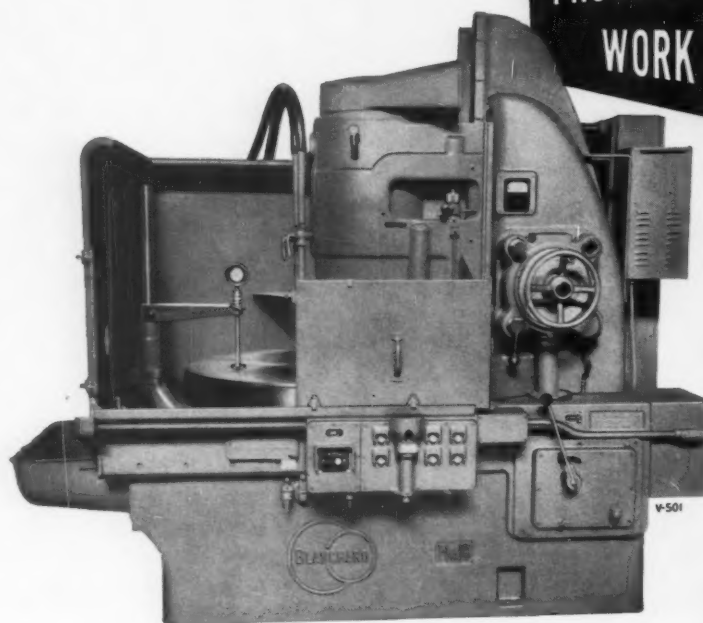
THE CLEVELAND TWIST DRILL CO.

1242 East 49th Street • Cleveland 14, Ohio

Stockrooms: New York 7 • Detroit 2 • Chicago 6 • Dallas 2 • San Francisco 5 • Los Angeles 58

E. P. Barrus, Ltd., London W. 3, England

for BEST results in surface grinding...
PUT IT ON THE BLANCHARD



Blanchard Grinders are used throughout industry on surface grinding jobs that demand the utmost in production, finish and accuracy.

Whatever you're surface grinding, there's a Blanchard designed to do the job speedily and accurately.

PUT IT ON THE 

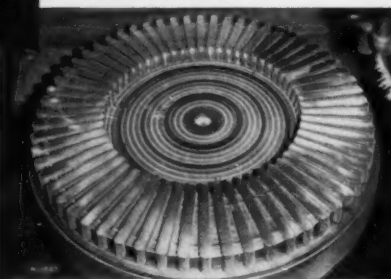
Send for free copies of "Work done on the Blanchard", fifth edition, and "The Art of Blanchard Surface Grinding".

THE BLANCHARD MACHINE COMPANY
 64 STATE ST., CAMBRIDGE 39, MASS., U. S. A.

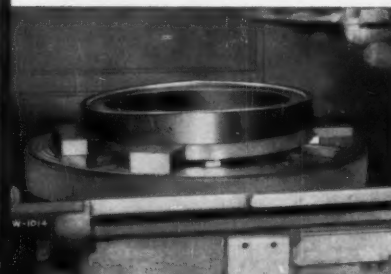
**PRODUCTION
 WORK**



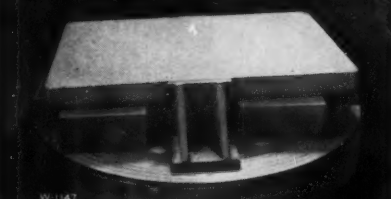
SIDE PLATES. 9" x 18" plates ground from rough on No. 18 Blanchard with 36" chuck. Stock removal 1/16" to 1/8" per side. Held flat within .003", parallel to .001", and to dimension tolerance of $\pm .001$ ". Production: 30 surfaces per hour.



CONNECTING LEVERS. Cast iron levers ground in special magnetic fixture with pins located in "vee's". Stock removal per side is 1/32" to 1/16"; must be flat and at right angles to pins. No. 18 production: 130 pieces per hour, compared to 20 pieces per hour by former method used.



HARDENED STEEL PUNCHES. This 24-13/16" dia. punch, reground on a No. 18, is centered radially on 36" magnetic chuck. Duplicate circumferential and radial shear reliefs are generated with two setups.



GRANITE SURFACE PLATES. A No. 18 Blanchard reconditions this 18" x 34" granite surface plate by grinding it flat within .0002". 3/16" of stock is removed in 5 hours.

**MAINTENANCE
 AND
 ODD LOT WORK**



AUTO MAKERS are making tremendous strides in weeding out obsolescence from their 40,000 drilling machines and 26,000 lathes.* They well recognize that over half their machines were built to World War II standards. In fact, over half the entire country's production is limping along with machine tools that are over 10 years old. This is no news to our enemies . . . nor to your alert competition. Yet modernization is quick and inexpensive with "Standard Machine Tools" developed against fresh, new concepts of appearance, function and accuracy. To this end, Cincinnati Lathes and Drills are built to do much of your jobbing, tooling, maintenance and light production work at tremendous savings. Write for complete catalog information. Cincinnati Lathe & Tool Company, 3247 Disney, Cincinnati 9, Ohio.

*Figures from American Machinist's Seventh Inventory.

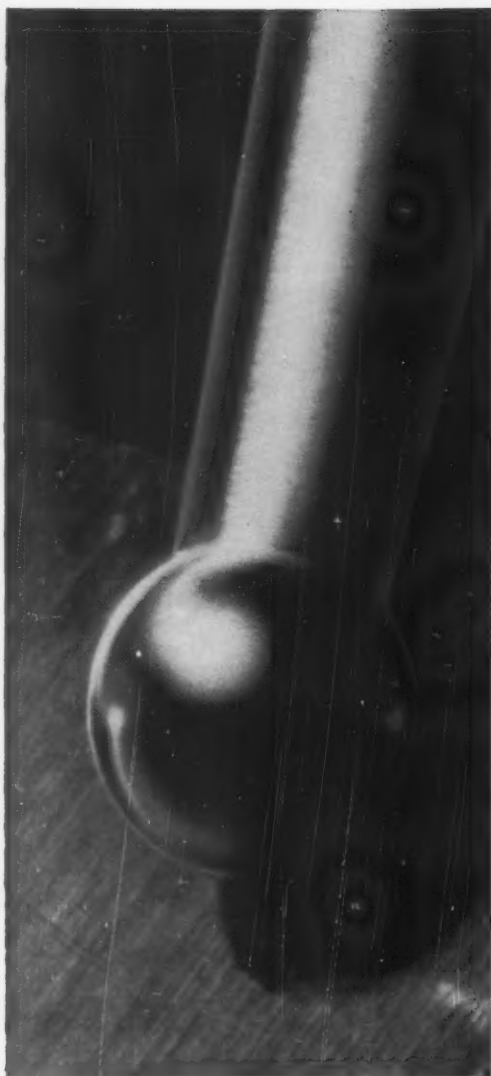


center on... **cincinnati lathes and drills**

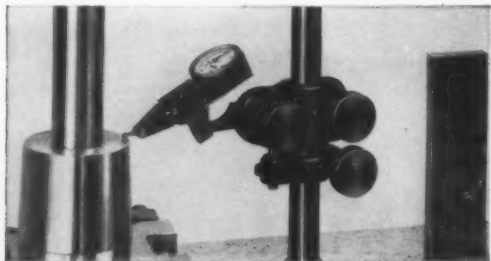


Machines shown are Cincinnati's new 21" Sliding Head Drill and 15" Tray-Top Lathe.

PRINTED IN U.S.A.



CHECK MASTER contact point on work piece shown 20 times actual size. To see the smallest variations CHECK MASTER will detect, illustration would need to be 500 times actual size.



CHECK MASTER in use checking face location on surface plate.

The importance of measuring practically nothing

In gaging, the smaller the variation, the harder it is to measure. Yet, accurate checking of microscopic variations is what makes the difference between ordinary and truly fine precision manufacture.

CHECK MASTER

Is so unusually sensitive that it responds to dimensional variations as fine as .000020"!

Use this versatile precision instrument in setting up work ON a surface and truing pieces IN machine tools. You'll find it superior in actual feature-by-feature comparison to any similar device in the industry. (See chart below)

COMPARATIVE ANALYSIS OF TEST INDICATORS

	STANDARD CHECK MASTER	Make A	Make B	Make C	Make D	Make E
Bearings Jeweled	ALL	Some	None	None	None	Some
Bearings Removable	ALL	Some	Some	None	ALL	ALL
Pivot Ends Covered	YES	YES	No	No	No	YES
Ratchet Contact Point	YES	YES	YES	No	YES	No
Contact Pressure (gr.)	15-15	23-33	23-33	23-23	45-49	28-38
Contact Pressure Equal in Both Directions	YES	No	No	YES	No	No
On-Center Mounting Vertical & Horizontal	YES	No	Vert. Only	No	Vert. Only	No
Absence of Reversing Lever	YES	No	No	YES	No	No
Total Weight (grams)	29	42	33	70	77	35
Hand Rotation Always Clockwise	YES	No	No	YES	No	No
.001" & .0001" Con- vertible	YES	No	No	No	No	No

Write today for complete information
Ask for CHECK MASTER Bulletin.

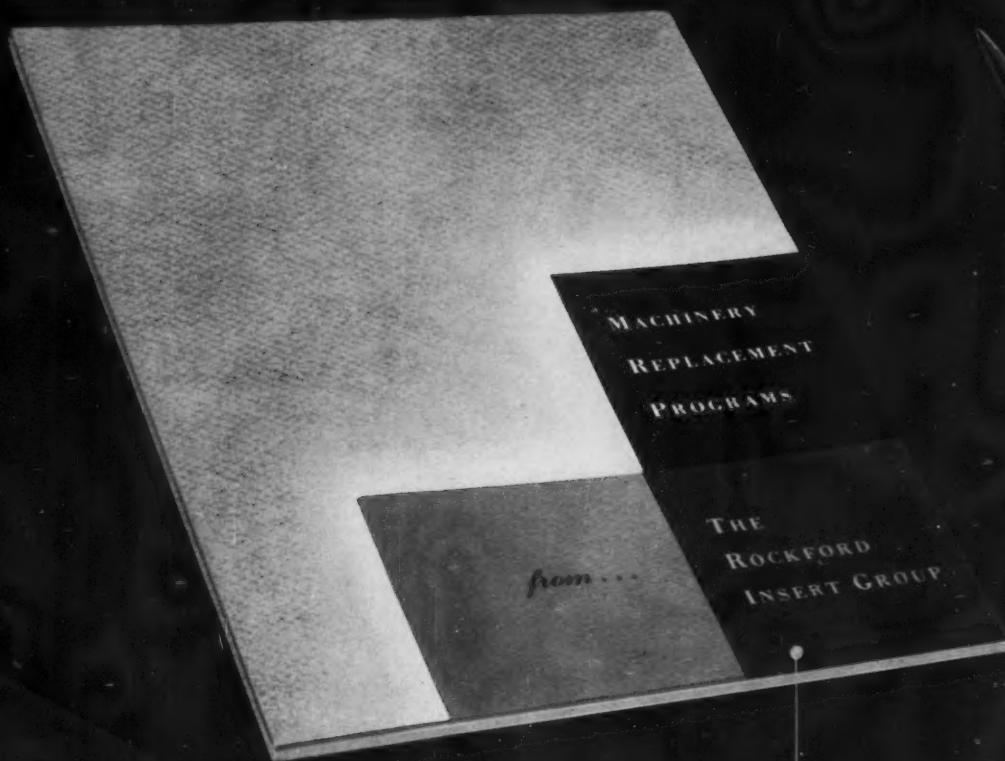


STANDARD

Gage Company, Inc.

142 Parker Ave., Poughkeepsie, N. Y.

STANDARDIZE ON STANDARD FOR PRECISION GAGES



If you have a *finger* in
Machinery and Equipment
buying you should have **this book**

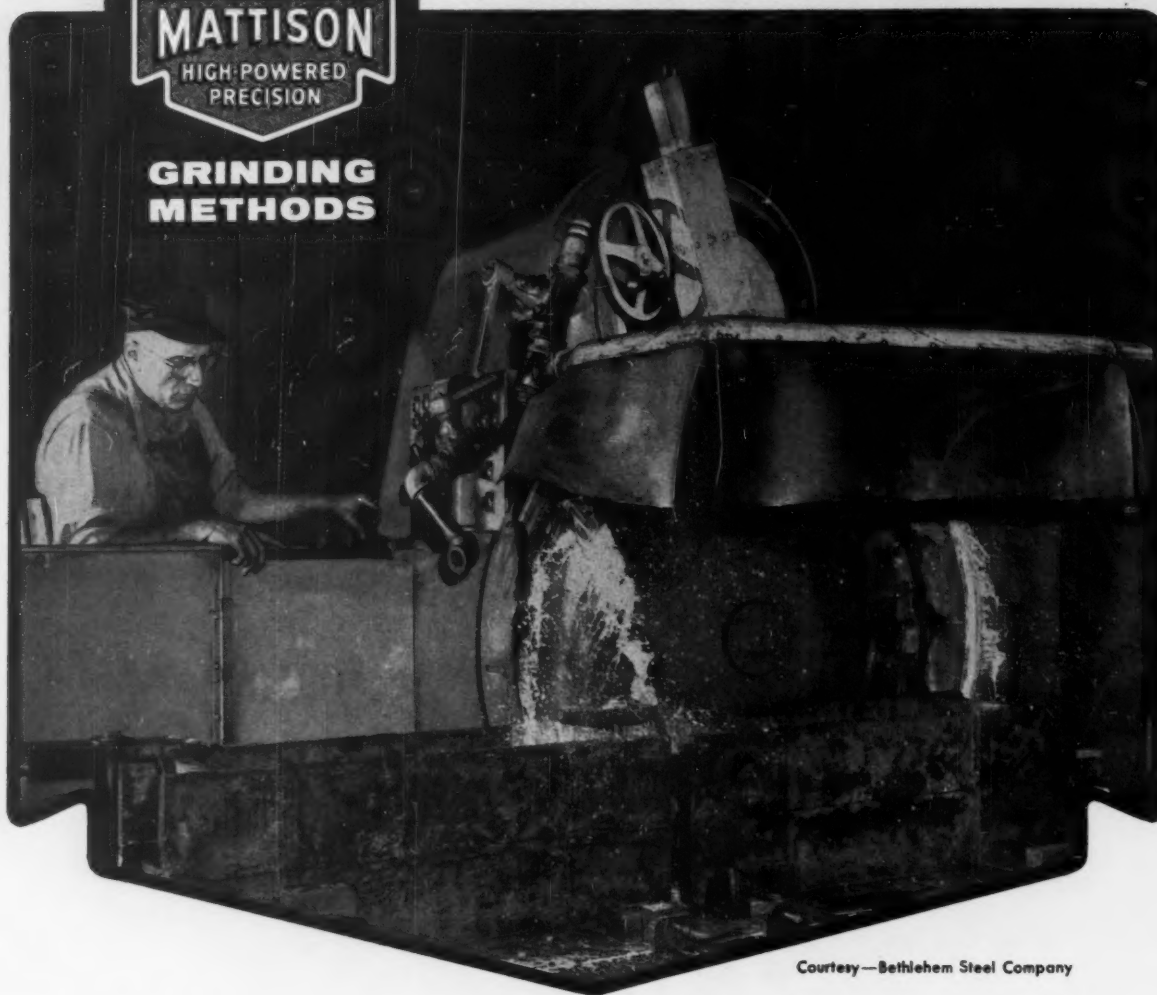
Fifteen prominent industrialists discuss their machinery and replacement programs in this book. This valuable information represents the most up-to-date collection of evidence of the importance of such programs in industry today. For your free copy merely write to any one of the companies in the Rockford insert group.

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production ideas . . . be well
informed when you replace
machinery*

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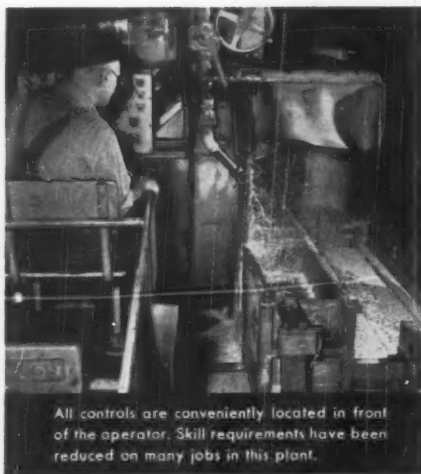


GRINDING METHODS



Courtesy—Bethlehem Steel Company

Switch from planer to face grinder boosts production 200 to 300 per cent



All controls are conveniently located in front of the operator. Skill requirements have been reduced on many jobs in this plant.

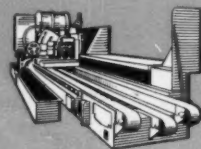
Large cast steel brake bases, formerly machined on a planer, are finished three to four times as fast and more efficiently on this Mattison "UK" Traveling Wheel Face Grinder. Surface finish has been improved considerably, and it is now easier to machine the brake bases to required accuracy limits. The machine is so simple to operate and easy to set up, operator skill requirements have been reduced with resultant savings in direct cost.

Many jobs formerly done on a planer or milling machine are now being ma-

chined faster and more efficiently on the Mattison "UK." The large traveling wheel—feeding at the end of each stroke—takes a positive cut and covers the entire work surface on each pass. All cuts are finishing cuts, whereas first operations on the planer or milling machine had to be roughing cuts.

This Mattison Face Grinder offers an excellent solution to the problem of grinding large, heavy, and over-length parts. Floor space required is only half that needed for a traveling table machine. Write for Bulletin No. 844.

IF IT'S A FLAT SURFACE
THERE IS A MATTISON
TO GRIND IT

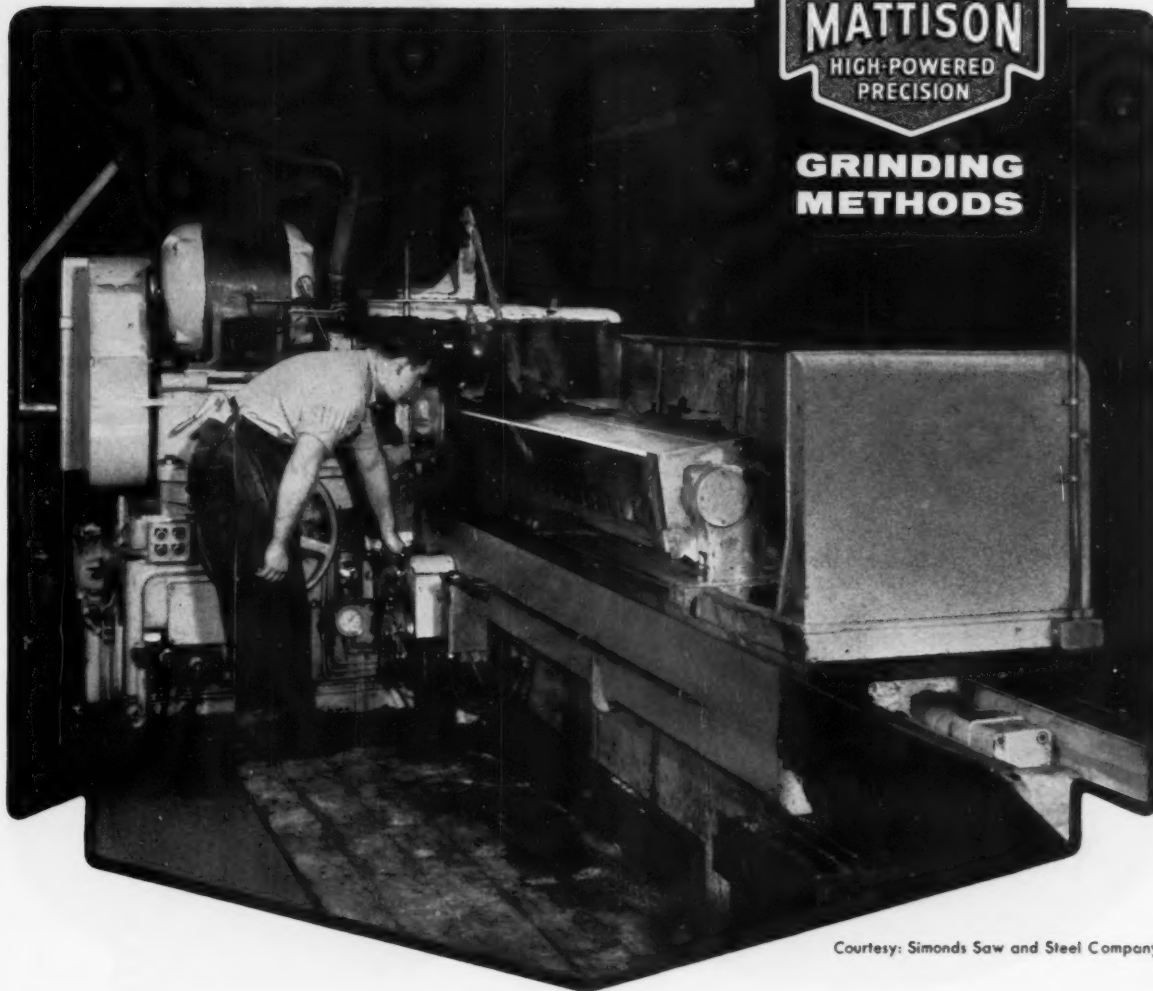


Machinery, November, 1956

MACHINES DESIGNED TO MEET YOUR NEEDS **ROCKFORD, ILLINOIS, U.S.A.**



GRINDING METHODS



Courtesy: Simonds Saw and Steel Company

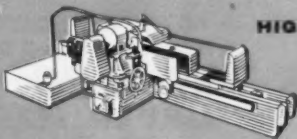
Face-grinding accurate bevels on machine knives ...loading and unloading simplified!

For quick setups on long, narrow work, a Mattison Traveling Table Face Grinder offers many unusual advantages.

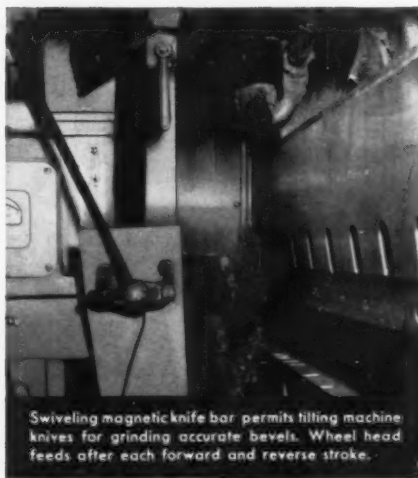
At Simonds Saw and Steel Company, Fitchburg, Mass., this machine grinds accurate bevels on machine knives held on a revolving magnetic knife bar. Open design of the machine makes it easy to load and unload the long carbon steel knives. The high-powered spindle motor permits heavy stock removal, and the heavy-duty spindle is vibration-free, assuring close accuracy under these

heavy stock removal conditions.

If you are machining shear blades, pump castings, electric motor frames, generator housings, large bearing caps, or large dies—some of which may now be milled, broached, or machined on a planer—why not do it faster, remove less metal, and get a more accurate job by using a face grinder? Vertical magnetic chucks or swiveling magnetic knife bars reduce fixture costs. All machine controls are centralized for fast, efficient operation. Write for Bulletin No. 846.



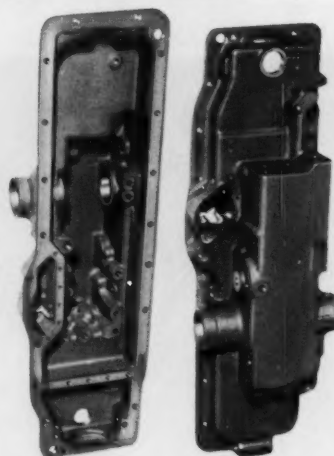
**HIGH-POWERED
PRECISION
SURFACE
GRINDERS**



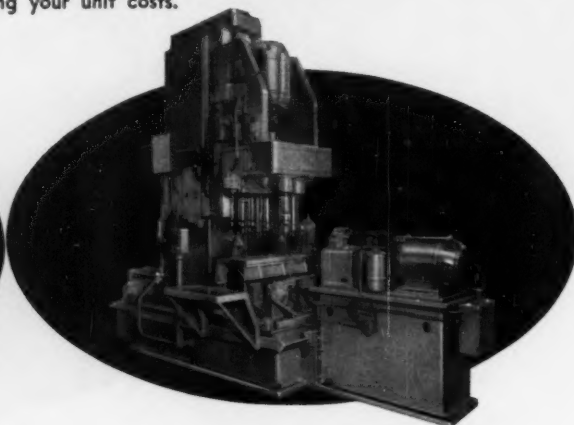
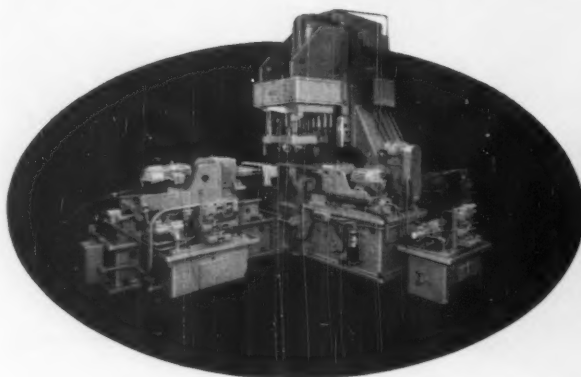
Swiveling magnetic knife bar permits tilting machine knives for grinding accurate bevels. Wheel head feeds after each forward and reverse stroke.



combine 115 operations
in 2 production steps!



Barnesdril engineering can give you any desired guaranteed rates of production, combining a series of multiple operations into a single timed cycle. Send us part prints with detailed operations, or invite one of our engineers to call and discuss recommendations for improving your unit costs.



drill, ream, bore and tap all surfaces at once
ON **BARNESDRIL twin-production machines**

These 2 machines work as a unit to complete all operations — top, bottom, sides and ends of two gray iron housings — in two successive production steps.

The first machine drills, bores and reams 2 housings simultaneously, one with milled surface up, and one with milled surface down. These parts are then transferred to the second machine for 38 tapping operations.

Not only are all surfaces exposed at once for machining, but a precision relationship between all operations on the part is maintained because all machining is done at one time in the same fixture. The result is great savings in production time and improved work quality.

DETROIT OFFICE: 3419 South Telegraph Road, Dearborn, Michigan



BARNES DRILL CO.

820 CHESTNUT STREET • ROCKFORD, ILLINOIS



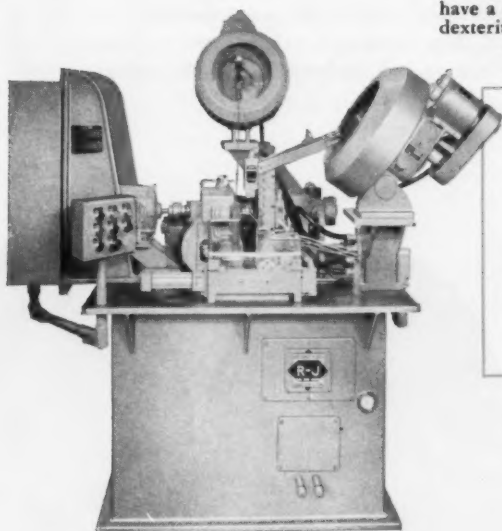
Machinery, November, 1956

CENTER OF MACHINE-TOOL EXCELLENCE **ROCKFORD, ILLINOIS, U.S.A.**

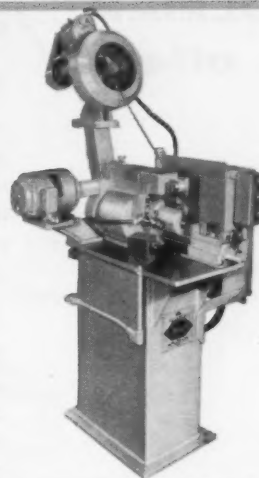
NEEDLE BEARING ASSEMBLERS

A LONG-TIME SPECIALTY OF REHNBERG-JACOBSON

TWO HOPPER. The machine below automatically assembles and greases a set of needles and a simple cup. All the operator has to do is to keep the hoppers loaded with parts and take the completed assemblies away from the delivery table. Capacity is approximately 900 assemblies per hour on this particular machine.



ONE HOPPER. At the right we show a typical semi-automatic machine which lends itself to certain kinds of work—short run, for example—better than a full-automatic. The operator manually sets the part piece, then the needles are delivered and the assembly completed automatically. Machines of this nature have a capacity governed largely by the dexterity of the operator.

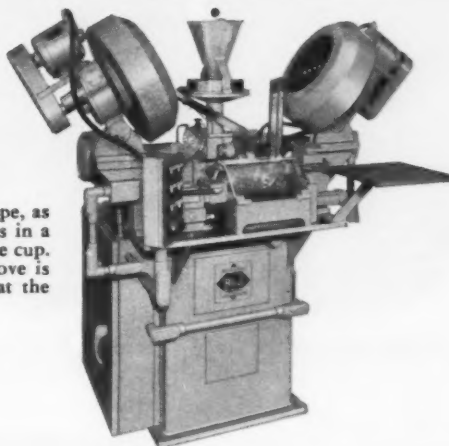


A TYPICAL NEEDLE BEARING



The bearing shown here is typical of the many for which we have built assembly machines. The needles are set into the cup, after which the retainer ring is pressed in place. At the proper time, a measured shot of lubricating grease is delivered into the assembly. This particular bearing is used on universal joints.

THREE HOPPER. A machine of this type, as shown at the right, can be used to press in a retainer after the needles are placed in the cup. For example, the bearing illustrated above is assembled on this particular machine at the rate of 900 per hour.



OTHER POSSIBILITIES. The versatility of Rehnberg-Jacobson Needle Bearing Assembly Machines offers the opportunity to handle almost any assembly of three or four elements. Send samples or prints of your bearings: gears, levers, or other parts for advice and quotation.

REHNBERG-JACOBSON
MANUFACTURING CO.
ROCKFORD, ILLINOIS



DESIGNERS, ENGINEERS
MANUFACTURERS AND
PRODUCTION CONSULTANTS

Machinery, November, 1956

CITY OF MACHINE-TOOL SPECIALISTS

ROCKFORD, ILLINOIS, U.S.A.



solve special production problems

**BARBER-
COLMAN
offers**

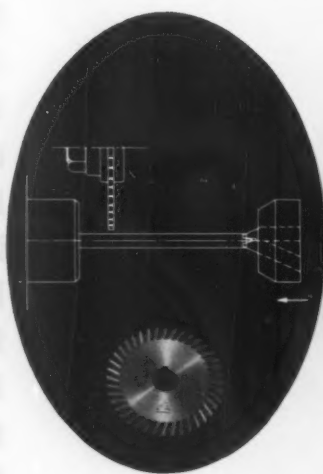
**top engineering talent
for milling cutter application and design**

Milling Cutter Application

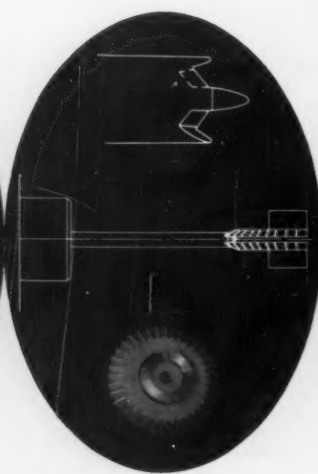
This is engineering talent for visualizing how a production operation can be best accomplished through developing the right milling cutters. Barber-Colman cutter engineers have developed this talent to a fine degree through nearly fifty years of cutter design and shop experience. This experience is available to you without cost when you ask Barber-Colman engineers to work with you on your production problems.

Milling Cutter Design

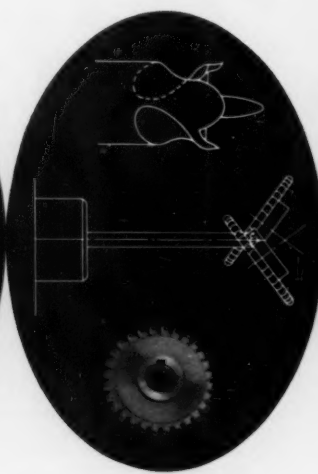
This is engineering talent for making milling cutters work better by combining certain physical elements into the cutter teeth. Such features include side cutting clearance, helical gashes, rake angles and cutter tooth form development, and are the result of many years of actual shop experience. These features, when applied correctly, increase the cutting efficiency and performance of the cutters, thereby producing better job economy.



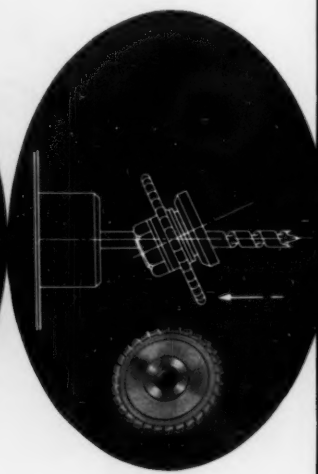
Finished Bit Cut-Off



Topping Cut Forms Cut-
ting Spurs — 2 Cutters



Throat-Opening Cut
Forms Lead Edge —
2 Cutters



Milling First Flute

If you are seeking ways to improve production methods and cut manufacturing costs, consult Barber-Colman cutter engineers for counsel and suggestions on milling cutter application and design. Many times this cutter engineering advice can simplify your problems.



Machinery, November, 1956

CENTER OF MACHINE-TOOL EXCELLENCE

ROCKFORD, ILLINOIS, U.S.A.

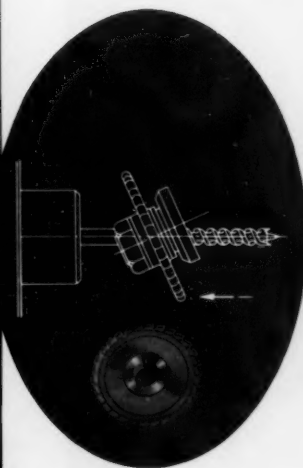
working with experienced cutter engineers



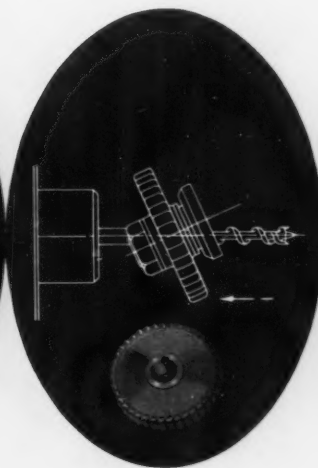
*Greenlee eliminates hand operations,
aided by Barber-Colman cutter engineers.*

Greenlee Tool Co., manufacturer of wood boring bits, has eliminated costly hand operations and now produces bits automatically on controlled-cycle machines, using Barber-Colman special milling cutters. These machines, designed and built by Greenlee Bros. Co., were exhibited at the Machine Tool Show last year.

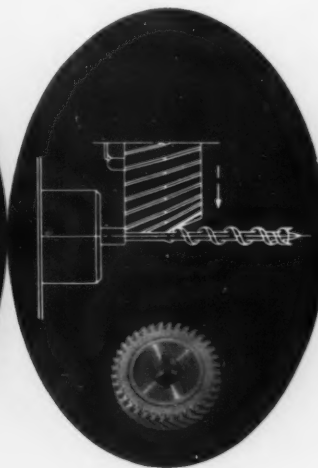
Greenlee engineers visualizing an automatic method to replace all hand operations, designed and built a battery of automatic machines which produce semi-finished solid-center auger bits from bar stock. They asked Barber-Colman engineers to help in the design of cutters which would complement the automatic operation. The sequence of operations is shown here with the corresponding cutters.



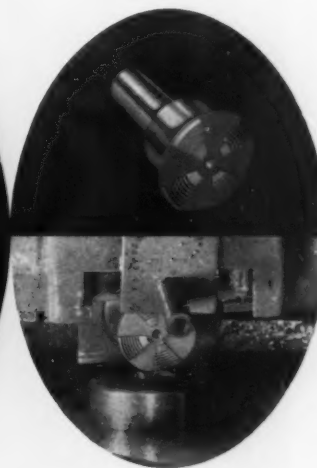
Milling Second Flute



Flute Milling Removes
One Land



Taper Mill Shank



Thread Milling Screw Point

BARBER-COLMAN COMPANY

8211 ROCK STREET • ROCKFORD, ILLINOIS

Hobs • Cutters • Reamers • Hobbing Machines • Hob Sharpening Machines



Machinery, November, 1956

FOR PRODUCTION MACHINE TOOLS IT'S **ROCKFORD, ILLINOIS, U.S.A.**

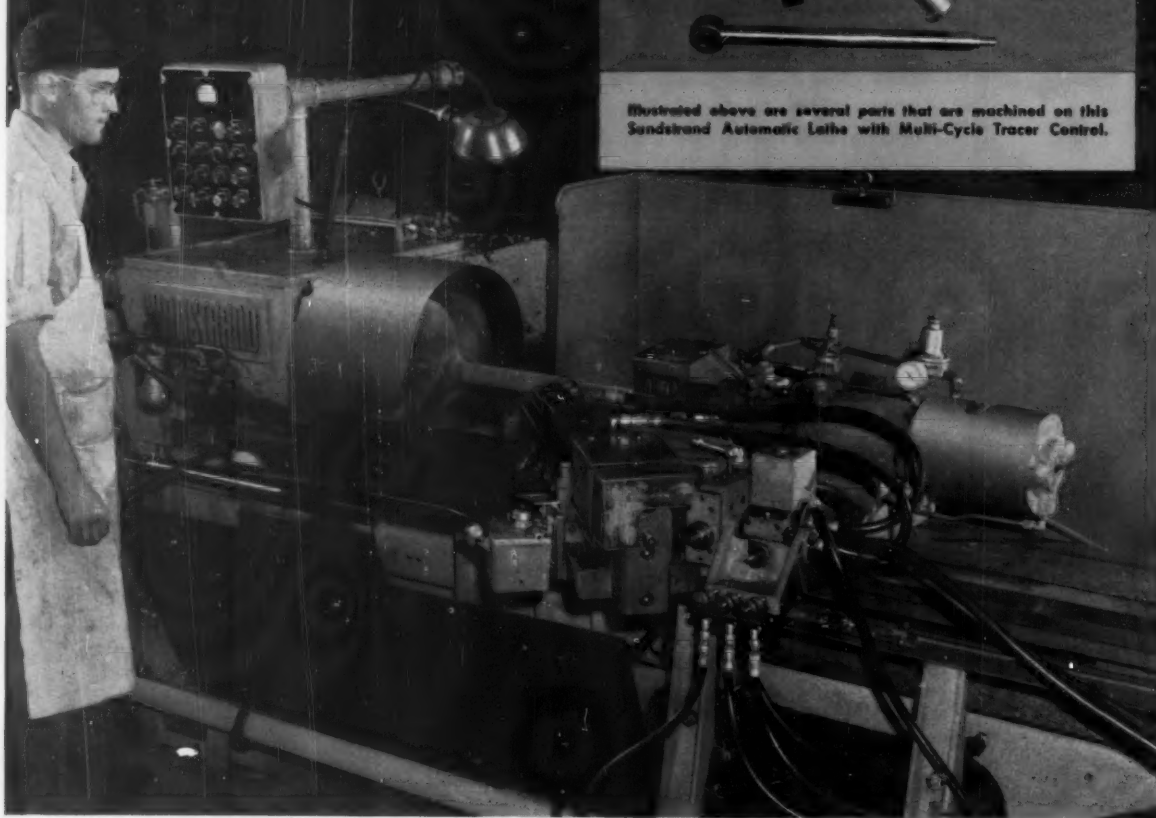


80%

Production Increase

**on miscellaneous
TURNING JOBS!**

with **SUNDSTRAND**
Automatic Lathe equipped
with Multi-Cycle Tracer Control . . .

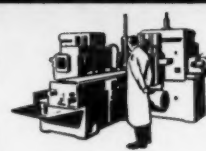
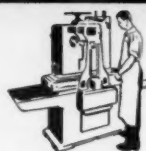
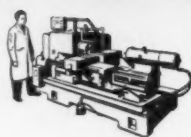


Illustrated above are several parts that are machined on this Sundstrand Automatic Lathe with Multi-Cycle Tracer Control.



*"Engineered
Production"
Service**
*REG. U.S. PAT. OFF.

AUTOMATIC LATHES | SIMPLEX RIGIDMILS | DUPLEX RIGIDMILS



Machinery, November, 1956

CENTER OF MACHINE-TOOL EXCELLENCE

ROCKFORD, ILLINOIS, U.S.A.

controlled automatic lathe for turning various parts as illustrated.

Multi-cycle single point turning of irregular shapes can be obtained quickly and easily with Sundstrand Automatic Lathes equipped with this tracer control. The lathes are provided with a template controlled tracing unit, which replaces the regular front carriage. Ruff, semi-finish and finish cuts can be made with one turning tool in one automatic cycle and with *one* template. The control can be set up for one, two, three or four automatic cycles depending on job requirements. The regular cross feeding rear slide can be used to square up shoulders, chamfer, etc. Cycle changing is quick and easy requiring only 15 to 45 minutes depending on job and number of facing tools required in the job set-up.

LOT SIZES VARY FROM 1 TO 200 PIECES

The 18 different parts that are machined on this lathe vary in lot sizes from 1 to 200 pieces. The ease of set up and automatic cycle make it practical to run either small or large lots.

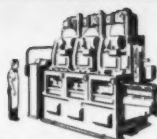
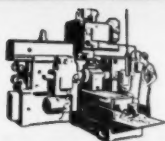
Get these Additional Facts

This folder will give you the facts you will need to determine the possibility of applying this machine to your work.

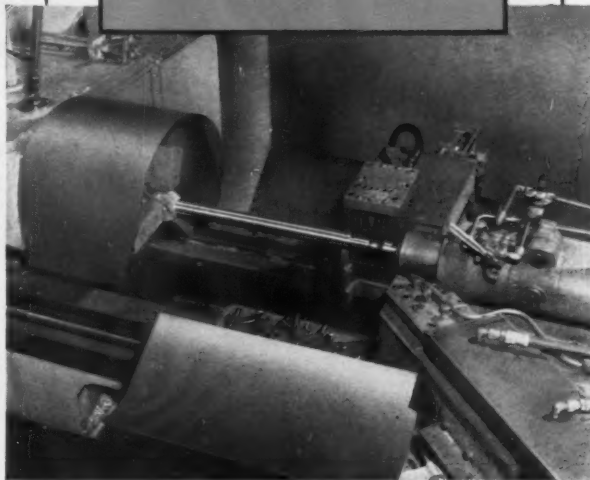


TRIPLEX RIGIDMILS

SPECIAL MACHINES



A TYPICAL EXAMPLE



This machine is a Sundstrand Model 8A Automatic Lathe with Multi-Cycle Tracer Control. This lathe performs turning, facing, chamfering and grooving operations. A total of 18 different parts, consisting of shafts, piston rods, gears, and couplings are machined on this lathe. These parts are of steel and cast iron.

The former method of machining required the use of two machines, an engine and a turret lathe. This one Sundstrand Multi-Cycle Tracer Lathe combined the operations performed by these two machines to give a production increase of 80%.

SUNDSTRAND Machine Tool Co.

2530 Eleventh St. • Rockford, Ill., U.S.A.

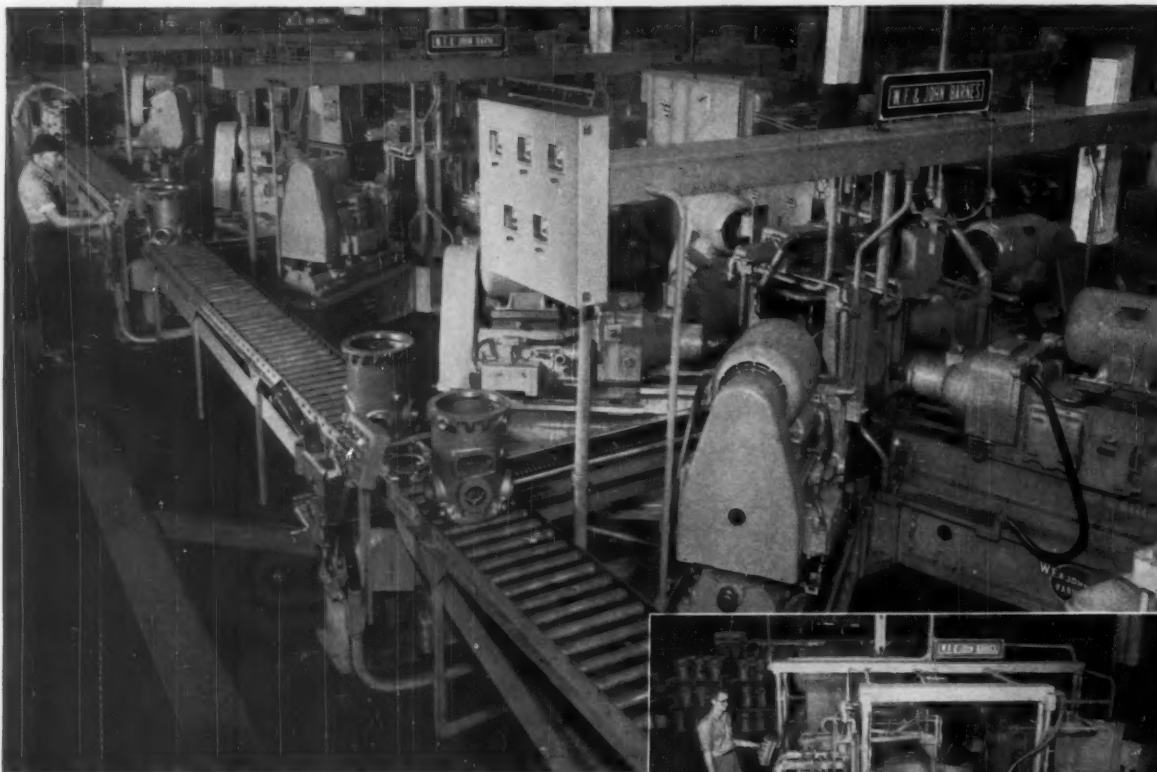
Machinery, November, 1956

FOR PRODUCTION MACHINE TOOLS IT'S **ROCKFORD, ILLINOIS, U.S.A.**



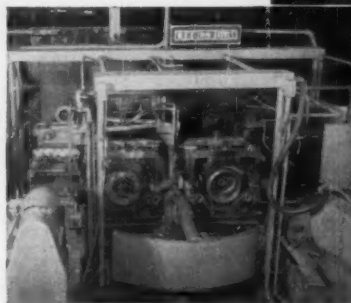
HOW W. F. & JOHN BARNES

"Specials" Cut Costs on



Overall view of three 5-Way Machines. First machine in foreground, bores and faces 5 flange holes; second, performs 8 combination drilling and chamfering operations; third, handles 14 tapping operations. All three machines are equipped with power transfer from gravity conveyor. One operator loads and unloads three machines at pushbutton stations.

View showing workpieces in center turntable after 180° turn, ready for traversing into new machining position. Machining cycle at station 2 allows operator time for unloading and loading at station 1 without losing production time.



4-Way Machine with reciprocating index fixture. Left-hand two-spindle heads drill and finish-ream .750" dowel holes in both ends. Right-hand single stub-spindle heads bore, chamfer and face stator and cylinder ends.



BUILDERS OF BETTER MACHINES SINCE 1872

MULTIPLE SPINDLE DRILLING • BORING • TAPPING

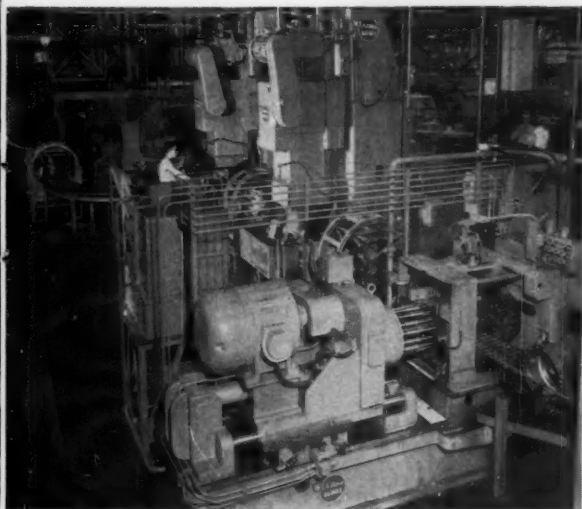


Machinery, November, 1956

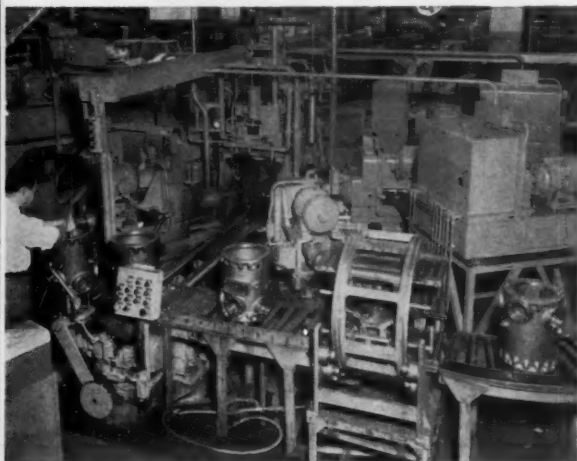
CENTER OF MACHINE-TOOL EXCELLENCE

ROCKFORD, ILLINOIS, U.S.A.

Low Production Work



Overall view looking toward end of line. Unit in foreground taps 31 holes in ends of piece and presses in two center bushings. Vertical machines are facing units for machining stator end and hub, and cylinder end and hub.



View of 6-Way Boring Machine for finishing five cylinder bores and two babbitted bushings. Concentricity of stator and crankshaft bores is held to max. of .005" T.I.R. Babbitt chips are collected in separate chip box. C.I. chips for entire line are flushed automatically to a central system.

MULTI-STATION UNITS REDUCE MACHINING TIME ON COMPRESSOR CRANKCASES 1.85 HRS. PER PIECE

At Airtemp Division, Chrysler Corporation, Dayton, Ohio, a battery of ten Barnes Multiple Spindle Machines are today demonstrating the efficiency and economy of special machines engineered to serve relatively low production requirements. Previously, the compressor crankcases used in Airtemp's fine line of large 5-cylinder commercial air conditioning units were drilled, milled, bored, faced, and tapped in single operation machines. Now, most of these operations are performed automatically in Barnes specials. As a result, machining and handling time has been reduced 1.85 Hrs. per case. In addition, close tolerances are more easily maintained which has increased product quality.

PRODUCTION GEARED TO 15 CRANKCASES PER HOUR

The Barnes Multiple-Spindle Specials are incorporated into a semi-automatic production line which is geared to produce 15 crankcases per hour. Parts are moved between machines on gravity conveyors, and operators manually position workpieces into the loading station of each machine. Powered turnover and transfer devices are included to minimize manual effort. After more than 12 months of operation, the new line has effected savings equalling the preliminary estimates of Airtemp Engineers, and at the same time has provided the additional capacity to meet an increased demand for their product with little increase in floor space.

INVESTIGATE BARNES SIX-POINT COORDINATED MACHINE BUILDING SERVICE

We suggest you investigate the profit possibility of applying Barnes special machines to your work. Find out, too, how Barnes six-point coordinated engineering and building services can help you eliminate divided responsibility and save time. Write for free brochure or ask for an analysis on any specific job.



W. F. & JOHN BARNES COMPANY

402 SOUTH WATER STREET • ROCKFORD, ILLINOIS

MACHINES • AUTOMATIC PROGRESS-THRU AND TRANSFER TYPE MACHINES

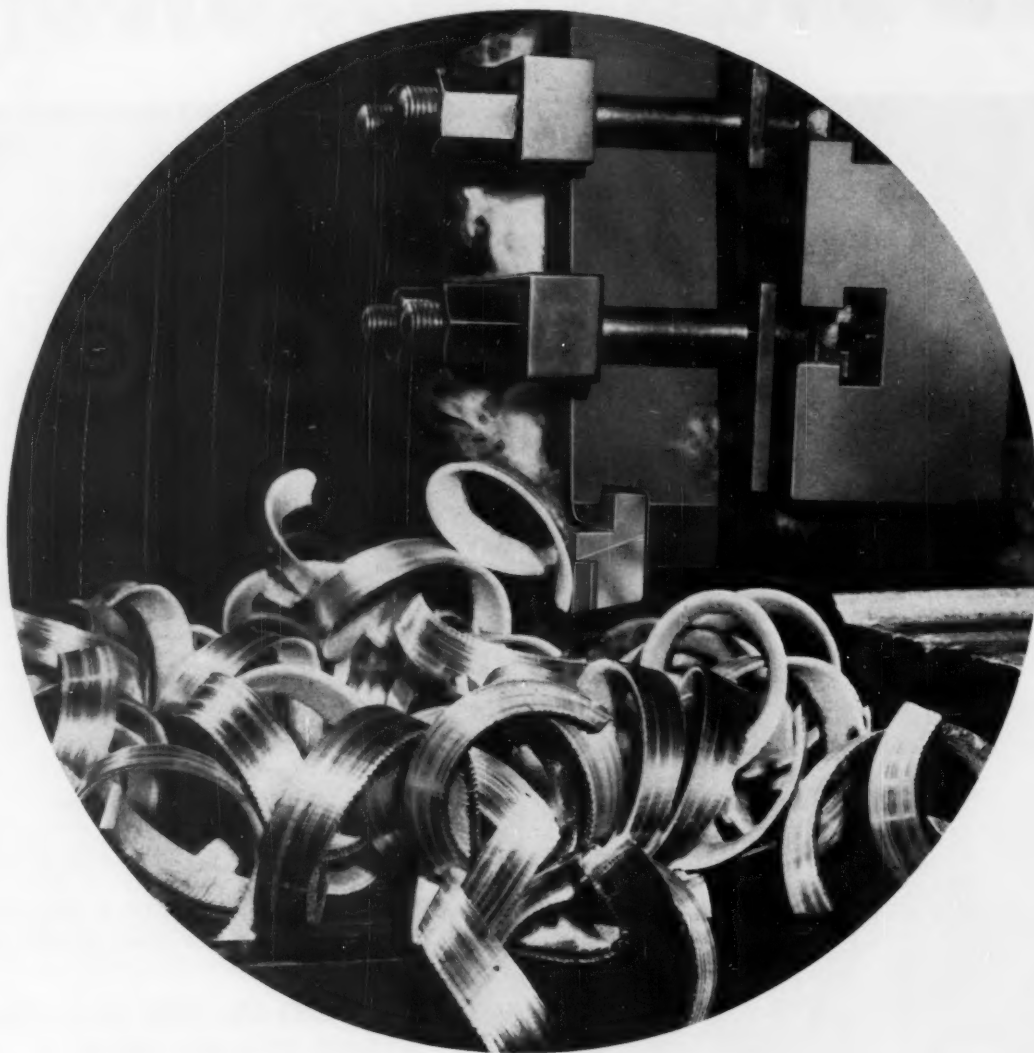
Machinery, November, 1956

FOR PRODUCTION MACHINE TOOLS IT'S

ROCKFORD, ILLINOIS, U.S.A.



speeds for carbides **plus** heavy-cut efficiency



low range to 100 fpm . . . for extreme depths of cut and maximum feeds

medium range to 150 fpm . . . for average cuts in medium steel or cast iron

high range to 300 fpm . . . for carbide planing of steel and non-ferrous metals



Machinery, November, 1956

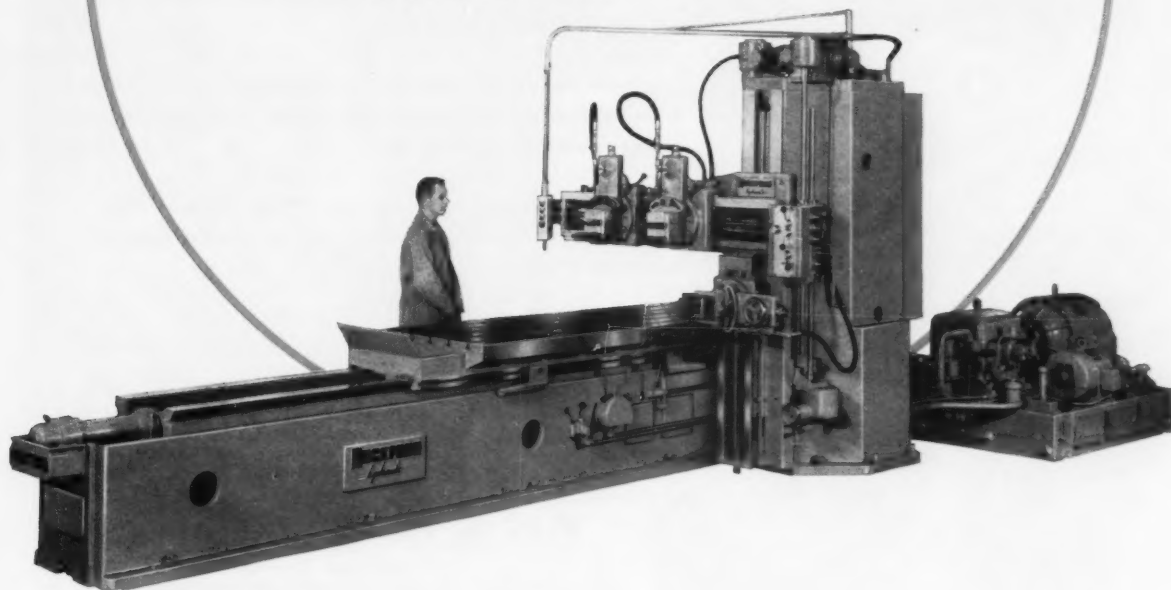
MACHINES DESIGNED TO MEET YOUR NEEDS **ROCKFORD, ILLINOIS, U.S.A.**

with triple circuit **h3** drive

The new heavy duty Model OGN Hydraulic Shaper-Planers are equipped with triple circuit h3 drive to combine the ruggedness and cutting efficiency of single circuit planers, with the speeds required for carbide planing. Three distinct ranges of cutting speed are provided, with power inversely proportional, to give the correct combination of speed and force to most economically machine any metal.

Hydraulic drive is ideally suited for carbide tooling, since optimum cutting speeds can instantly be set for any tool. Tools also enter the cut more smoothly with hydraulic drive to reduce the tendency for fracturing brittle carbide tips.

A Rockford Machine Tool Co. representative can demonstrate these advantages for you. Ask your local dealer for full details, or write us for a copy of Bulletin No. 1200.



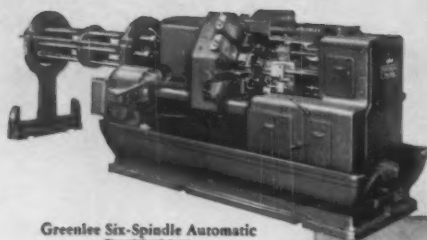
ROCKFORD MACHINE TOOL CO.
2500 KISHWAUKEE STREET • ROCKFORD, ILLINOIS



Machinery, November, 1936

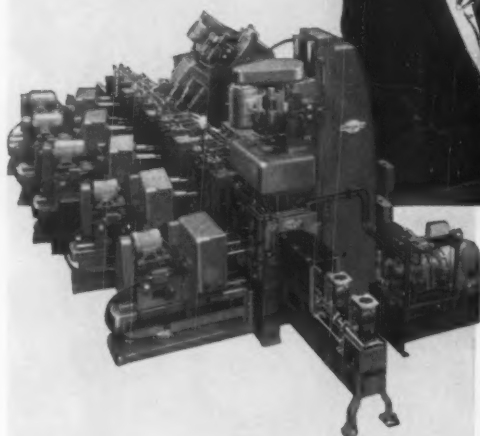
FOR PRODUCTION MACHINE TOOLS IT'S **ROCKFORD, ILLINOIS, U.S.A.**





Greenlee Six-Spindle Automatic Bar Machine.

Greenlee 22-Station Automatic Transfer Machine for machining transmission cases.



Greenlee 10-Station Automatic Transfer Machine.



GREENLEE OFFERS

A PROFIT-MAKING INVESTMENT IN HIGH-PRODUCTION MACHINE TOOLS



Greenlee creative thinking, Greenlee engineering and Greenlee experience combined with that of your own engineers will help you "produce more at lower cost."

Ideas, engineering, experience and facilities of Greenlee Bros. & Co. develop improved methods and machines for greater and greater productivity of future models.

Greenlee's adequate facilities expedite the transition from production ideas to production machines . . . a profit-making investment at work in your plant.

GREENLEE STANDARD AND SPECIAL MACHINE TOOLS

- Multiple-Spindle Drilling and Tapping Machines
- Transfer-Type Processing Machines
- Six and Four-Spindle Automatic Bar Machines
- Hydro-Borer Precision Boring Machines

Write for Further Information



GREENLEE BROS. & CO.
1874 Mason Ave.
Rockford, Illinois



Machinery, November, 1956

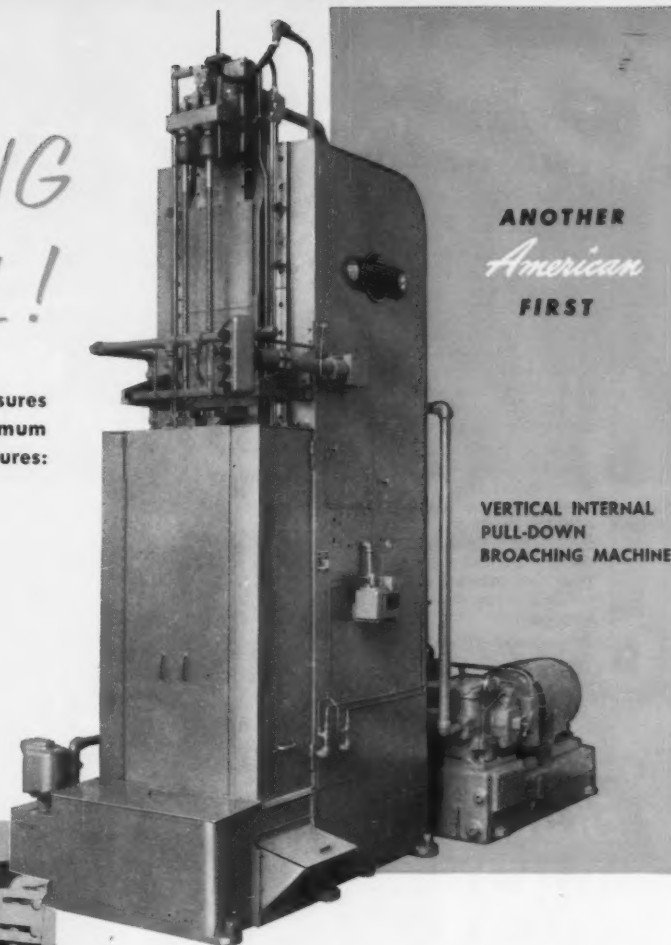
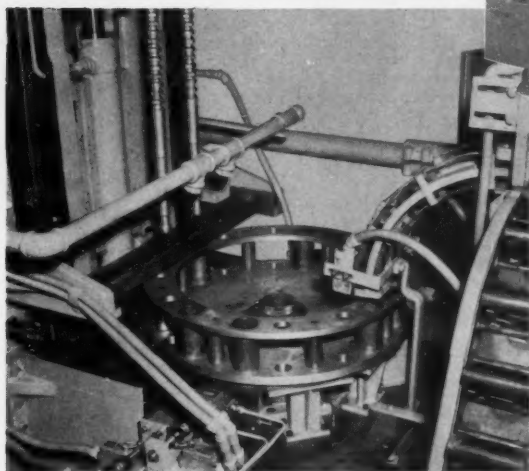
MACHINES DESIGNED TO MEET YOUR NEEDS **ROCKFORD, ILLINOIS, U.S.A.**

POSITIVE BROACHING CONTROL!

This NEW American Pull-Down Machine assures high production internal broaching and maximum machine efficiency by these positive control features:

*NEW retriever unit is built integral with a massive machine slide — provides continuous, rigid broach support through the major portion of the broaching stroke.

*NEW chip-free, radially-locked puller design—insures that broaches are locked securely in position before the machine cycle can continue.



ANOTHER
American
FIRST

VERTICAL INTERNAL
PULL-DOWN
BROACHING MACHINE

AUTOMATION FLEXIBILITY

Illustrated at the left, the NEW American Pull-Down Machine is tooled for full automation of parts from the floor to the dial-index unit pictured, and on through broaching position to final parts ejection back to the production line. Such automatic components can be added initially or later as individual production requirements demand, and without the usual high cost of special engineering.



The NEW American Vertical Internal Pull-Down Broaching Machine is completely electrically controlled, with all elements interlocked for maximum tooling safety and machine efficiency. High speed production at constantly maintained tolerances becomes a fact through American "Engineered Production."

Write today to see how American can solve your internal broaching problem. Ask for Catalog No. 800.



American BROACH & MACHINE CO.

A DIVISION OF SUNDSTRAND MACHINE TOOL CO.

American Building - Ann Arbor, Michigan

See *American* First — for the Best in Broaching Tools, Broaching Machines, Special Machinery



Machinery, November, 1956

CITY OF MACHINE-TOOL SPECIALISTS **ROCKFORD, ILLINOIS, U.S.A.**

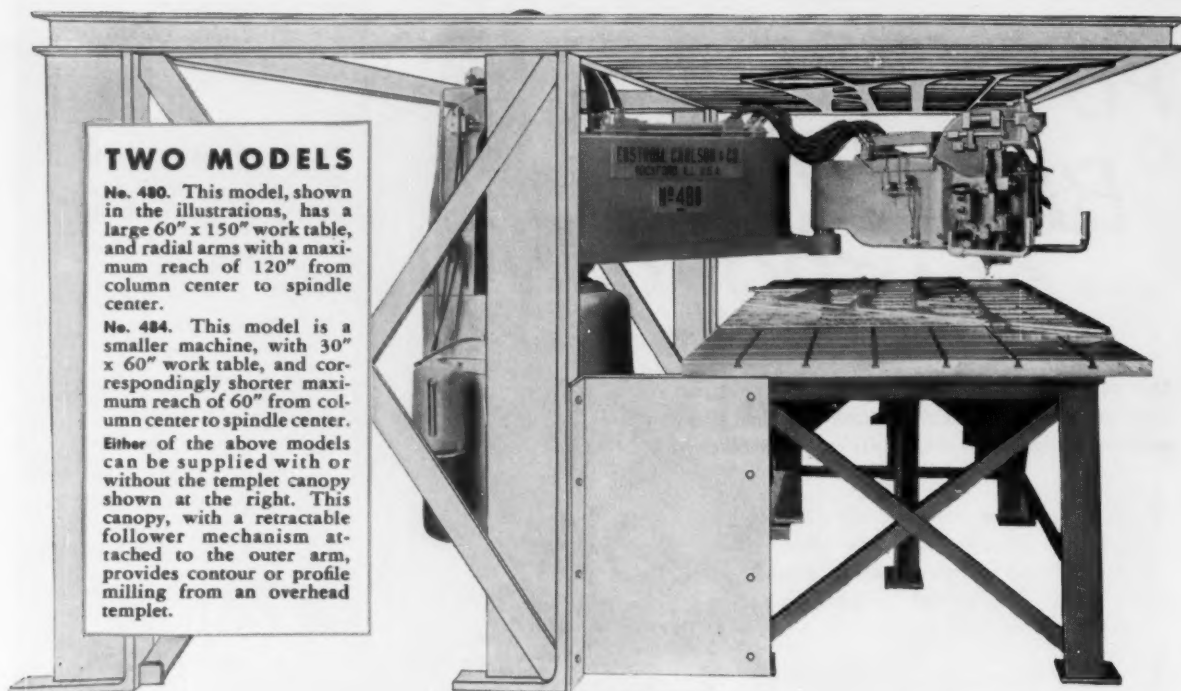


TWO MODELS

No. 480. This model, shown in the illustrations, has a large 60" x 150" work table, and radial arms with a maximum reach of 120" from column center to spindle center.

No. 484. This model is a smaller machine, with 30" x 60" work table, and correspondingly shorter maximum reach of 60" from column center to spindle center.

Either of the above models can be supplied with or without the templet canopy shown at the right. This canopy, with a retractable follower mechanism attached to the outer arm, provides contour or profile milling from an overhead templet.



EKSTROM, CARLSON

RADIAL-ARM DEPTH AND CONTOUR MILLS



Manually-operated, radial-arm machines are recognized by airframe builders as the *fastest* and *most economical* for profile or contour milling. These new Ekstrom-Carlson profile milling and routing machines have the *additional* feature of *depth* milling. For low initial cost, low maintenance, and high production capacity, there is no other machine or method that will out-perform the new Ekstrom-Carlson No. 480 and No. 484.

NEW STANDARDS OF HIGH PERFORMANCE!

Outstanding machine-tool performance is due largely to important features: Rigidly designed base, column, and arm structures are machined to close limits for accuracy. Hydraulically-actuated cylinders, mist lubrication to motor bearings, independently operated follower and cutterhead assemblies

with double slides, four-position depth stops with micrometer adjustments, water-cooled cutterhead motors, drawbar type collets, and many other valuable improvements. For details, write for data and specifications — or see your Ekstrom-Carlson representative.

EKSTROM, CARLSON & CO.

1400 RAILROAD AVE., ROCKFORD, ILL.
Machine Tools, Special Machines, Cutters
SINCE 1910



Machinery, November, 1956

MACHINES DESIGNED TO MEET YOUR NEEDS **ROCKFORD, ILLINOIS, U.S.A.**

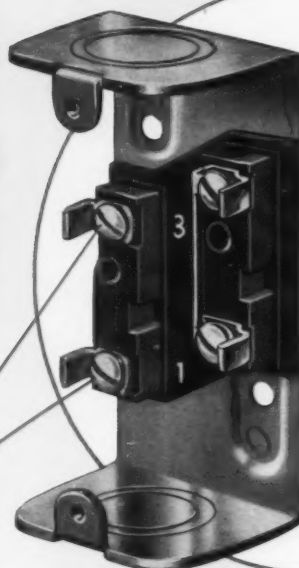
Brand New Idea

in STANDARD-DUTY STATIONS



THE CONTACT MECHANISM IS IN THE COVER!

THESE ARE THE WIRING TERMINALS!



EASIER TO WIRE!

No skinned knuckles

No cramped wiring space

Here's an entirely new idea in push button stations—a wrap-around cover—with the contact mechanism part of the cover. Removing the cover exposes the terminals for instant and easy wiring. Strong, spring type, silver plated contacts connect the push button assembly in the cover with the terminals in the base.

Matching ribs in the cover and notches in the terminal blocks assure that the wiring connections are always correctly made. A bakelite shield

protects the contact mechanism and prevents careless wiring from interfering with the contact operation. Concentric knockouts are provided in both top and bottom of the heavy metal base.

You will want to know about this new standard-duty station because—it is good looking—it takes less time to install—it was designed for the convenience of the installation engineer.

Let us show you a sample of this "brand new idea" in standard-duty stations!



ALLEN-BRADLEY

MOTOR CONTROL

Allen-Bradley Co., 1316 S. Second St., Milwaukee 4, Wis.
In Canada—Allen-Bradley Canada Ltd., Galt, Ontario

Bulletin 800 standard-duty push button stations can be supplied with one, two, or three buttons, or as a selector switch. Also available with pilot light. Furnished only in NEMA Type 1 enclosures.



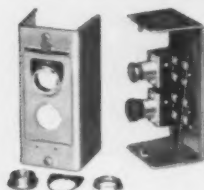
9-56-MR

Also... **NEW HEAVY-DUTY PUSH BUTTONS**

BULLETIN 800



NEW FLEXIBILITY!



You can assemble any special heavy-duty station from a small stock of standard push button, selector switch, and pilot light components. There is no need to wait for long delivery of your special stations.

Stations can be arranged for either vertical or horizontal mounting. Name plates can be rotated to any position, replaced with any standard marking, or removed entirely.

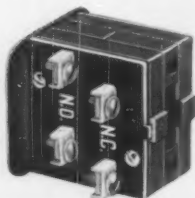


NEW ENCLOSURES!

Each button, selector switch, or pilot light is a self-contained unit which can be mounted in attractive new enclosures. Standard enclosures accommodate up to eight units, but enclosures can be furnished for larger numbers.

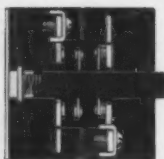


NEW CONTACT BLOCK!



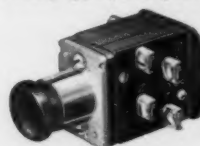
Above: View of contact block, showing terminals for normally open and normally closed contacts. Right: Contact block, with cover removed, showing stationary silver alloy contacts and pushrod carrying the moving contacts.

Bulletin 800 heavy-duty push buttons have the same molded contact blocks that have proved so dependable in Bulletin 800T oiltight push buttons, although they are not themselves oiltight. And all of them are equipped with double break, silver alloy contacts.

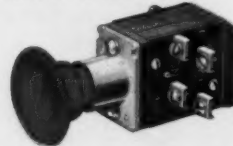


NEW OPERATORS!

Operators, which mount on the contact block, are available in many types, and push buttons come in various colors.



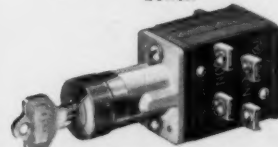
Type AK2B flush head START button



Type DK6A mushroom head button



Type PK16 pilot light with transformer



Type EK11B cylinder lock unit

9-56-MR

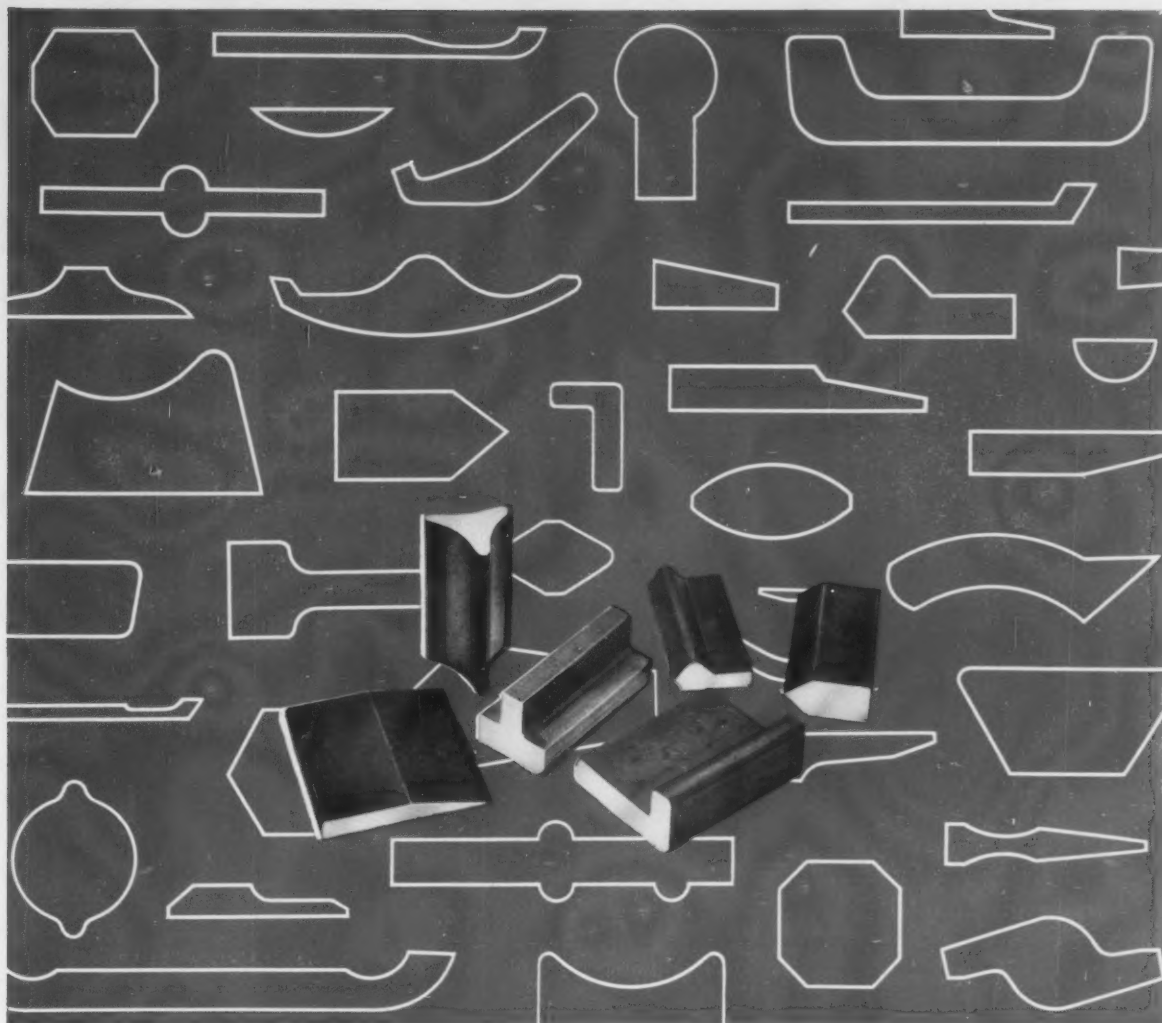


ALLEN-BRADLEY

QUALITY
MOTOR CONTROL

Allen-Bradley Co., 1316 S. Second St., Milwaukee 4, Wis.

In Canada—Allen-Bradley Canada Ltd., Galt, Ontario



Crucible special shapes

for better alloy steel parts at lower cost . . .

If you're machining intricate sections from solid bars—or using expensive forgings—stop! Choose instead, a *Crucible special shape* that approximates the finished part. *Crucible special shapes* eliminate rough-machining operations . . . reduce scrap losses.

There's practically no limit to the *special shapes* available at Crucible, in a wide variety of

alloy steels. Rolls for over 400 special shapes are available—other shapes can be rolled to your specifications. Your local Crucible representative can give you the whole story of how *special shapes* can cut costs—save time. *Crucible Steel Company of America, The Oliver Building, Mellon Square, Pittsburgh 22, Pa.*

CRUCIBLE

first name in special purpose steels

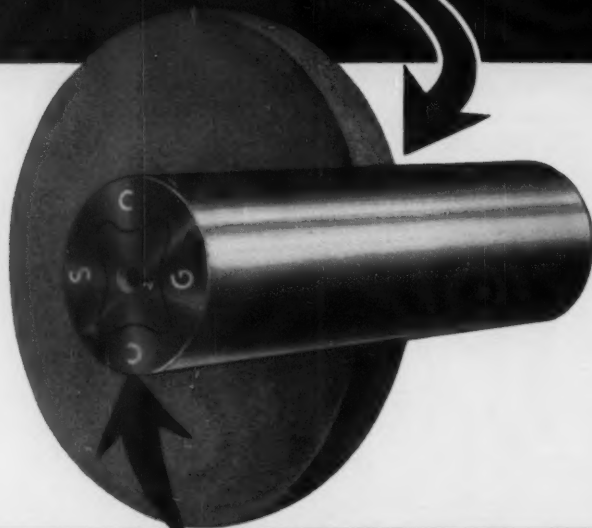
Crucible Steel Company of America

For more information fill in page number on Inquiry Card, on page 275

MACHINERY, November, 1956—105

An exclusive GRINDING PROCESS...

makes
**CUMBERLAND
STEEL BARS**
concentric, straight,
smooth & *really* accurate



BE SURE OF THIS MARK ON THE END OF YOUR SHAFTS

CUMBERLAND GROUND BARS FOR ALL TYPES OF MACHINES

They are carefully ground to our standard manufacturing tolerance, plus nothing to minus .002" on diameters 1-1/8" to 2-7/16" inclusive . . . plus nothing to minus .003" on diameters 2-1/2" to 8" inclusive. Closer tolerance can be furnished, if desired. And, remember, Cumberland Steel Bars are the end result of 109 years' experience,—and every bar is *carefully tested* before shipment. The list of Cumberland's customers reads like the "Blue Book" of Industry. Ask for further information.

MANUFACTURED IN THREE SPECIFICATIONS

Cumberland Brand—AISI C-1020/C-1025, Elastic Limit 30,000# Min.

Potomac Brand—AISI C-1040, Elastic Limit 45,000# Min.

Cumscs Brand—AISI C-1141, Elastic Limit 57,000# Min.

CUMBERLAND STEEL COMPANY

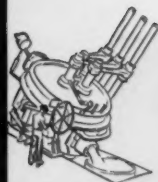
CUMBERLAND, MARYLAND, U.S.A.

ESTABLISHED 1845

INCORPORATED 1892

106—MACHINERY, November, 1956

For more information fill in page number on Inquiry Card, on page 275



Tool Steel Topics



On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Sales Corporation

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

Export Department Bethlehem Steel Export Corporation



Bearcat Puts the Eye in Eye Bolt ... And Does It Economically

Putting the eye in an eye bolt is one thing, but doing it quickly, accurately and economically on thousands of pieces is something else again. J. H. Williams & Co., Buffalo, who make wrenches, tools and drop-forgings, changed to Bearcat for the punching operation shown here. They found that because of Bearcat's fine wear-resistance and shock-resistance, the punch provided a service life about

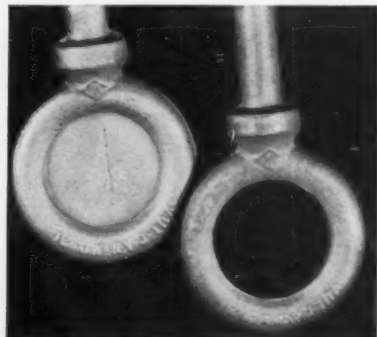
50 pct longer than the one previously used.

The Bearcat punch, hardened to Rockwell C 56-58, works on steel stock $\frac{1}{8}$ in. and $\frac{5}{16}$ in. thick, and knocks out discs approximately $\frac{3}{4}$ in. in diameter. About 0.020 in. to 0.040 in. is removed in occasional redressing.

Bearcat is our super-tough, air-hardening, general-purpose grade of tool steel. It is perhaps best known for its exceptional resistance to shock and wear. Besides, its air-hardening characteristic minimizes quenching hazards, and also provides excellent resistance to distortion in heat-treatment.

Bearcat has a wide range of tough applications, too. In addition to its use in punches, it's a natural for rivet sets, chisels, gripper dies and hot-headers. It is also ideal for master hobs, and for dies used in blanking, bending, and cold-forming.

Your local tool steel distributor has a stock of Bearcat, and chances are good that he can furnish exactly what you need. Call him now, while you have it in mind.



BETHLEHEM TOOL STEEL ENGINEER SAYS:



*Choosing the Grade
Means More
Than Naming the Tool*

Let's say you have a general tool-and-die application, for which you are to select the proper grade of tool steel. How do you go about it? Obviously, it is not enough to know that the customer wants high hardness and good wear-resistance, for these properties are always required, in some degree. What you need are the answers to the following questions:

1. How is the tool to be made?
2. How is it to be used? Blanking? Forming? Cutting?
3. How is the steel to be heat-treated?
4. Are machinability and wear-resistance important?
5. How close must size be held after heat-treatment?
6. What is the previous experience with this job? Which steels were used and what results were obtained?

Selecting tool steel grades, even when you want perfection of operation, isn't too hard when sufficient data is available. But without adequate information, you may find your selection is disappointing.



TOOL STEEL MOVIE WINS ANOTHER AWARD

Bethlehem's tool steel color movie, "Teamwork," an award winner at film festivals at Columbus and Chicago, recently won a Certificate of Merit at the Cleveland Film Festival.

The 16-mm, 30-minute picture explains the quality control and heat-treatment of Bethlehem tool steel, and shows typical applications of the carbon, oil- and air-hardening, shock-resisting, hot-work, and high-speed grades.

It's excellent for showing to heat-treaters, die-makers, machinists and machine-tool manufacturers, as well as to technical societies and engineering students. If you would like to schedule a showing of "Teamwork," send your request to Publications Department, Bethlehem Steel Company, Bethlehem, Pa.

MACHINERY, November, 1956—107



REJECTIONS dwindle to a new low when you start running on USS Free-Machining MX Steel.

It's a fact. Ever since this faster-cutting bar stock was developed, and in every shop where MX has been put to work, not only have more parts per hour been produced but they have been *better* parts. Better in finish, accurate in dimension, lower in cost—and with fewer rejects to cut into profits.

These highly desirable results are obtained with USS MX primarily because of its superior machinability,

and also because this steel is consistently uniform in shipment after shipment. Uniform in cutting characteristics. Uniform in its composition and grain size. Uniform in freedom from defects and injurious imperfections.

Give USS MX a trial in your shop and watch production go up and costs come down. The performance of MX has been so universally superior that we feel sure that it will cut the cost of any part you now machine from ordinary screw stock.

USS Free-Machining MX is pro-

duced in both Bessemer and Open Hearth grades and is available in all the popular screw stock sizes. It is sold in cold-finished form by your regular supplier, either as "MX" or under his own identifying trade name. In hot-rolled form, MX is available through our nearest district sales office.

UNITED STATES STEEL CORPORATION, PITTSBURGH
AMERICAN STEEL & WIRE DIVISION, CLEVELAND
COLUMBIA-GENEVA STEEL DIVISION, SAN FRANCISCO
TENNESSEE COAL & IRON DIVISION, FAIRFIELD, ALA.
UNITED STATES STEEL SUPPLY DIVISION
WAREHOUSE DISTRIBUTORS, COAST-TO-COAST
UNITED STATES STEEL EXPORT COMPANY, NEW YORK

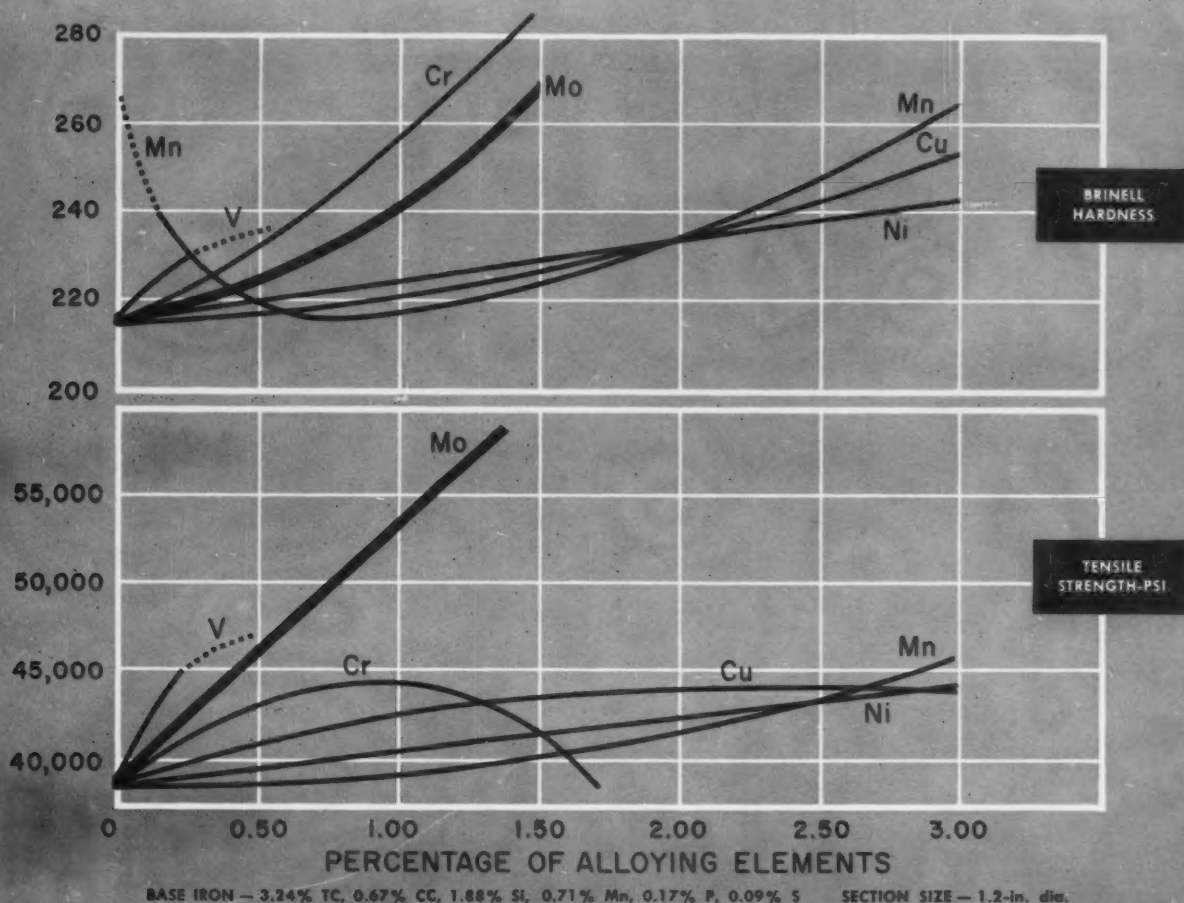
Bigger output... longer tool life... fewer rejects

—when you do the job with free-machining



MX

UNITED STATES STEEL



Note how additions of moly, up to 1.5%, produce proportional improvements in strength. And, with moly, hardness increases

much more slowly. It means higher strengths can be used with less danger of impaired machinability.

each 1/2% Moly adds 7000 psi to strength of cast iron...

A little moly adds a lot of strength — for molybdenum increases strength more than any other common alloying element, with the exception of small vanadium additions. A rule of thumb is that fifty points of moly raise tensile strength 7000 psi. And without sacrificing toughness. Actually, moly improves toughness at least as much as strength.

What's more, versatile moly aids in obtaining uniform response to heat treatment . . . and in producing machinable, growth-resistant castings. Moly is easy to use, too.

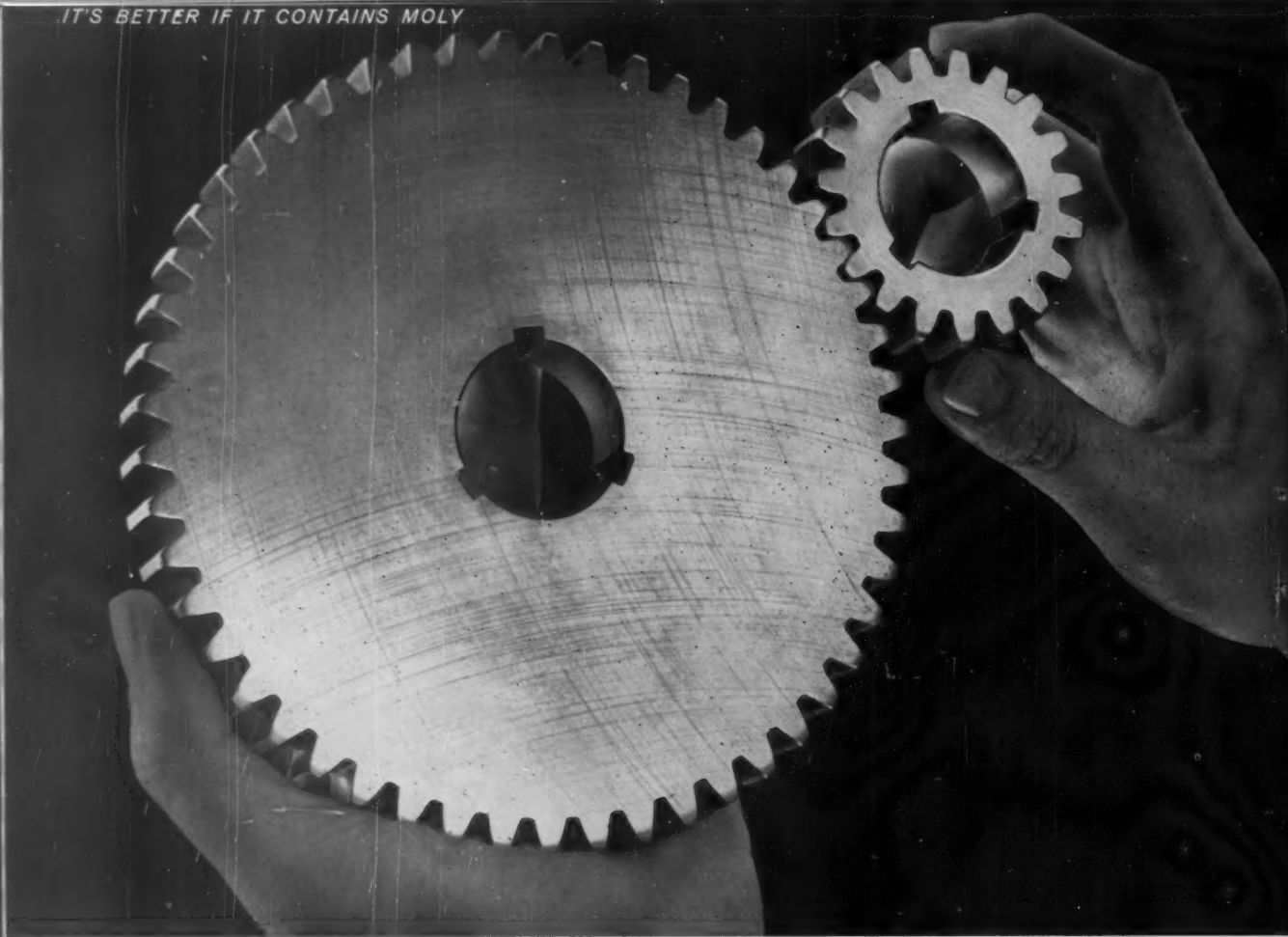
With most grades of cast iron, moly requires no change in the character of the charge, normal melting practice, or the base metal. And foundrymen like the fact that the small additions necessary may be made at the spout or in the ladle.

Write now for "Why Moly Iron". It's the full story of how and why moly adds strength faster than hardness, how it increases fatigue and torsional strength—in short why moly makes better cast iron. Climax Molybdenum Co., Department 13, 500 Fifth Avenue, New York 36, N.Y.

CLIMAX MOLYBDENUM



IT'S BETTER IF IT CONTAINS MOLY



Up to 1% Moly in carburizing steels gives required hardenability economically

Why limit the use of molybdenum to the .15/.25% Mo and .20/.30% Mo contents of the traditional grades? For the contributions of moly do not stop there. Laboratory tests and production runs prove that as molybdenum contents increase up to 1%, hardness increases progressively. A wide range of case and core hardenabilities, therefore, can be obtained — economically, too.

Tests with a series of molybdenum-manganese steels show that these compositions give higher case hardness on a direct quench than other steels of comparable core hardenability. One extensively tested composition, for example, is 0.5% Mo — 0.5% Mn steel. It shows longer

life, and is lower in cost than steels previously used. And it produces a higher case hardness with similar or less distortion. What's more, tool life and surface finish are equal or better. Good reasons why several companies have already adopted this grade for automotive gears and other critical applications.

If you use carburizing steels, see what a higher molybdenum content can do for you. Part of the story is contained in the technical article "New Carburizing Steels For Critical Gearing." For your copy, or other technical data, write Climax Molybdenum Co., Dept. 13, 500 Fifth Avenue, New York 36, N. Y.

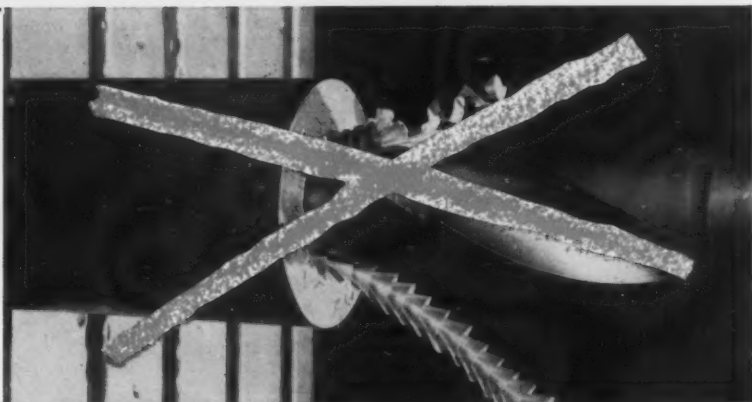
CLIMAX MOLYBDENUM



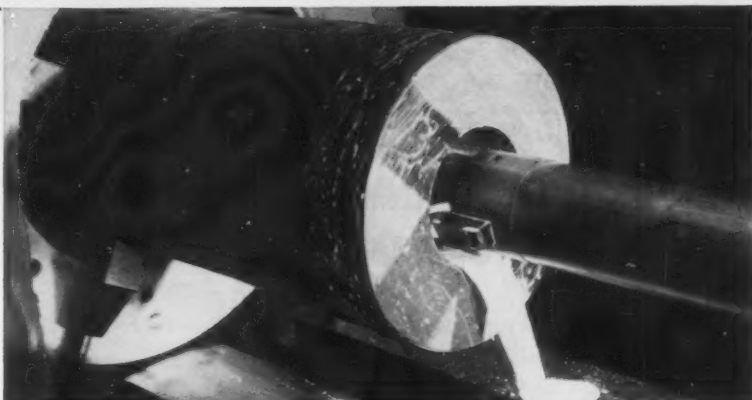
- High case hardness
- Wide choice of hardenability
- Easy to heat treat
- Low distortion
- Good machinability
- Good wear resistance

How to save a big step when you make hollow parts...

SKIP
drilling bar
stock



START
with finish boring
of TIMKEN®
seamless steel
tubing



WITH Timken® seamless steel tubing as your base stock, finish boring often is your first production operation in making hollow parts. You save a big step because you don't have to bore out the center hole. It's already there! And because Timken seamless tubing eliminates one boring operation, it frees part of your screw machines for other jobs. Result—you add machining capacity *without* adding machines.

And figure in this extra saving. With Timken seamless tubing you get more parts per ton of steel. There's less metal to hog out.

Timken Company engineers will study your problem,

recommend the most economical tube size for your hollow parts job—a size guaranteed to clean up to your finished dimensions.

You can get better quality products, too. Manufacture of Timken seamless tubing is basically a forging operation. It produces a uniform spiral grain flow for greater strength—a refined grain structure that brings out the best in the metal's quality. And this quality is uniformly maintained from tube to tube, heat to heat, order to order. Our metallurgists will gladly work with you, show you where Timken seamless steel tubing can save you money. The Timken Roller Bearing Company, Canton 6, Ohio. Cable address: "TIMROSCO."

TIMKEN *Fine Alloy* STEEL

TRADE-MARK REG. U.S. PAT. OFF.

SPECIALISTS IN FINE ALLOY STEELS, GRAPHITIC TOOL STEELS AND SEAMLESS STEEL TUBING

For more information fill in page number on Inquiry Card, on page 275

MACHINERY, November, 1956—111



HAVE YOUR CRANKSHAFTS RECONDITIONED BY A FIRM EXPERIENCED IN MAKING ORIGINAL CRANKSHAFTS

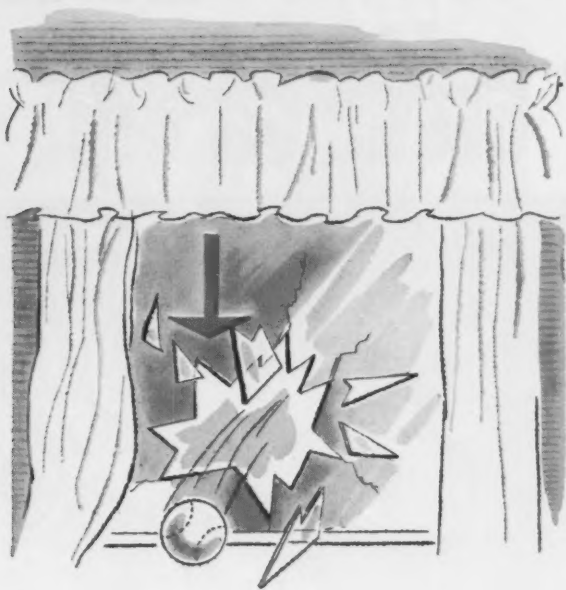
National Forge has been making crankshafts for diesel engines for many years... starting with our own basic electric steel and ending with a shaft ready to install in original equipment, we have a wealth of "know-how" regarding crankshafts.

Recently, National Forge has added a new crankshaft reconditioning division. This includes a large chromium plating department and additional grinding, straightening, and inspection equipment for handling crankshaft reconditioning on a production line basis.

National Forge's large modern facilities and years of experience in producing new crankshafts assure you of proper handling and good workmanship on your reconditioning jobs.

We will be glad to have our field representative call on you to discuss your needs.





a hole here means work...



a hole here saves work

Crucible Hollow Tool Steel Bars take much of the work out of making ring-shaped steel parts, or tools with a center hole. The hole's already there. You save expensive drilling, boring, cutting-off and rough-facing operations . . . you reduce machine time and scrap losses.

You can now get Crucible Hollow Tool Steel Bars in any of the famous Crucible tool steel grades, in virtually any I.D. and O.D. combination. And you can get *immediate delivery* from stock of the five most useful grades — KETOS oil-hardening . . . SANDERSON water-hardening . . . AIRDI 150 high-carbon, high-chromium . . . AIRKOOL air-hardening . . . NU DIE V hot-work tool steels.

Your Crucible representative can quickly show you how Crucible Hollow Tool Steel Bars will save you work and money. *Crucible Steel Company of America, The Oliver Building, Mellon Square, Pittsburgh 22, Pa.*

CRUCIBLE

first name in special purpose steels

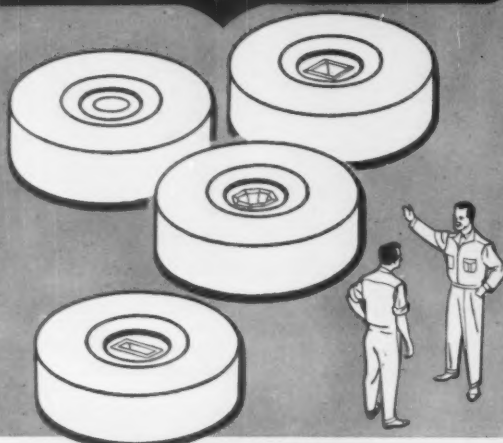
Crucible Steel Company of America

For more information fill in page number on Inquiry Card, on page 275

MACHINERY, November, 1956—113

A New and Better Chrome Carbide **CARMET** Grade CA-815

FOR HOT EXTRUSION DIES



BETTER RESULTS

BETTER DIE LIFE

because of . . . High resistance to oxidation at elevated temperatures.

BETTER SIZE CONTROL

because of . . . Excellent wearability.

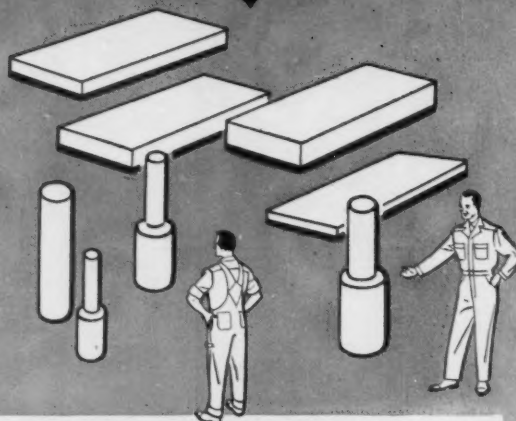
BETTER BAR FINISH

because of . . . High hot hardness.

LESS PICKUP AND GALLING

because of . . . Less affinity towards other metals.

FOR PRECISION GAGING



BETTER RESULTS

MORE ACCURATE GAGING

because of . . . Coefficient of expansion close to that of steel.

EXCELLENT SURFACE FINISH

because of . . . Low porosity.

EASY MAINTENANCE

because of . . . High resistance to corrosion.

LONGER GAGE LIFE

because of . . . Excellent wearability.

Write for the NEW CARMET CATALOG



. . . Completely revised, the 16th Edition of the Carmet Catalog contains the latest information on all Carmet grades, and on Carmet blanks, tools, die sections, etc.; also gives details on special preforming and how to order special parts.

Address Dept. M-83

Now for the first time a completely homogeneous chrome carbide is available . . . Carmet CA-815. Grade CA-815 is ideally suited for such operations as the two illustrated above . . . or for any application where resistance to corrosion as well as resistance to abrasion are a factor.

Carmet CA-815 is manufactured under controlled conditions. Die and gage makers are assured of complete dimensional accuracy and excellent surface conditions. Only minimum amounts of stock are left for finishing.

For further information on this and other Carmet carbide grades, call your Carmet Engineer . . . or write *Allegheny Ludlum Steel Corporation, Carmet Division, Detroit 20, Mich.*

For ALL your CARBIDE needs, call
Allegheny Ludlum



Giant LeTourneau Sno-Freighter built on rugged backbone of SHELBY SEAMLESS MECHANICAL TUBING



Another LeTourneau "train," also constructed with Shelby Seamless Mechanical Tubing, maneuvers through the streets of Longview, Texas. The uncovered control car reveals its 3,500-gallon fuel tank and its two diesel engines which generate electricity for driving the wheel motors.



Sno-Freighter in action in northern Alaska. The control cab is 17 feet high; the decks of the cargo carriers are 8½ feet high. Speeds range from 0 to 15 MPH.

The LeTourneau Sno-Freighter is a huge six-section cargo carrier specifically designed to travel over ice, frozen or compacted snow, bull-dozed trails, or rough brush land. It is presently in active use hauling fuel and other strategic materials to radar stations along the Arctic Coast.

The Sno-Freighter "train" consists of a power control car and five cargo cars, each with a capacity of 25 tons. Two 400 H.P. diesel-electric generating sets on the power control car supply electrical power to the 24 drive wheels, each of which has a powerful electric motor tucked into its rim. Thus, each wheel drives independently of the others, making it practically impossible for the carriers to get stuck in sand, snow, or swamp.

All of the Sno-Freighter's car frames are constructed of Shelby Seamless Mechanical Tubing in diameters from 2 inches to 8 inches. In addition, each of the cars is coupled to the one preceding it through a universal joint and

a long steel tube of Shelby Seamless. This constitutes the steering mechanism, causing each vehicle automatically to track the car ahead of it. The operator of the Sno-Freighter steers only the two front wheels of the power control car.

There are many good reasons why Shelby Seamless Mechanical Tubing was chosen for the supporting framework of this magnificent mechanical marvel. Primarily, it offers the ultimate in strength and rigidity in proportion to its size and weight. Secondly, it is shock-absorbent, uniform throughout, dimensionally accurate, and possesses excellent machining and superior welding properties. It is produced under rigid standards, and is available in a generous range of diameters, wall thicknesses, various shapes and steel analyses. And it can be fitted to your specifications, regardless of what they are. Contact our engineers. They will be happy to help you adapt Shelby Seamless to your requirements.

NATIONAL TUBE DIVISION, UNITED STATES STEEL CORPORATION, PITTSBURGH, PA.

(Tubing Specialties)

COLUMBIA-GENEVA STEEL DIVISION, SAN FRANCISCO, PACIFIC COAST DISTRIBUTORS
UNITED STATES STEEL EXPORT COMPANY, NEW YORK

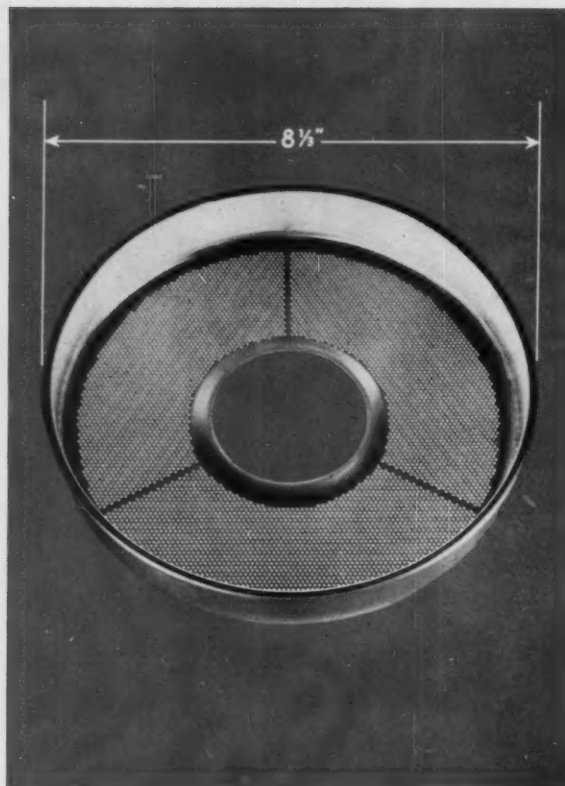


SHELBY SEAMLESS MECHANICAL TUBING



UNITED STATES STEEL

FIELD REPORT: NO. 2028



WHICH DIE STEEL WOULD YOU USE

to be sure of getting 6,066 perfect holes in this die?

These tools are used in a 60-ton press to pierce 6,066 holes of .036" dia. in aluminum filter pans for a popular home appliance. The job demands "almost everything" from the die steel . . . good machinability and uniformity, minimum size change, extra safety in hardening and toughness to withstand heavy press loads.

The filter pans are 8 1/2" in dia., and .025" thick. The 6,066 holes are perforated in three blows, as the die moves through three 120 degree indexing stations. Hundreds of machine hours are involved in drilling and taper reaming the tiny holes.

If the decision were up to you . . . on which die steel would you be willing to stake your reputation in view of this tough set of requirements?

In this Field Report from customer files, here are the amazing results: Working with Carpenter VEGA (Air-Tough) Die Steel, the company reports that not a single "hard spot" was encountered . . . all 6,066 holes are in the die as planned. The machining of VEGA was "considerably easier" than the machinery steel used for the stripper plate. What's more, there was no discernible change in size or shape after heat treatment . . . the die held perfectly!

You can count on good results from any Carpenter Matched Tool and Die Steel. Take the risk out of your tough tooling jobs. Call your nearest Carpenter Mill-Branch Warehouse, Office or Distributor now for immediate delivery.



Carpenter

Matched Tool and Die Steels

The Carpenter Steel Company, 105 W. Bern St., Reading, Pa.

Export Dept.: The Carpenter Steel Co., Port Washington, N. Y.—"CARSTEELCO"



star performer
...and among high speed steels
REX is the leader

Crucible REX® high speed steel has been the winner in shop tests for more than fifty years. *And now REX is even better than ever!* For Crucible research and experience has led to improved manufacturing techniques that mean higher quality — greater uniformity.

Prove the superiority of REX for yourself — on your next job. Check it for size, structure, response to heat treatment, all-around tool performance. Then you'll know why REX has always been the standard by which other high speed steels are compared.

REX is immediately available at all of Crucible's convenient warehouses — or through prompt mill delivery. For a list of available data on REX and other Crucible *special steels*, write for a free copy of the "Crucible Publication Catalog". Crucible Steel Company of America, The Oliver Building, Mellon Square, Pittsburgh 22, Pa.

CRUCIBLE

first name in special purpose steels

Crucible Steel Company of America

Canadian Distributor — Railway & Power Engineering Corp., Ltd.

For more information fill in page number on Inquiry Card, on page 275

MACHINERY, November, 1956—117

HERE are TWO important advantages you get with Oakite Composition No. 98 in solvent spray washing:



1 *Effectively cleans parts between machining operations*

2 *Protects work against indoor rust*

OAKITE COMPOSITION No. 98—new emulsifiable solvent cleaner expressly designed for use in one and two-stage spray-washing equipment—safely removes light to moderate soils from all metals.

WHILE REMOVING THE SOIL, Oakite Composition No. 98 also gives machined parts a non-tacky film to protect them against indoor rust during temporary storage.

FOR REMOVING EXTRA HEAVY SOILS, Oakite Composition No. 98 may be used in combination with recommended Oakite alkaline detergent, using a two-stage pressure spray washer.

Read what enthusiastic users have to say about Oakite Composition No. 98. Then call your local Oakite Technical Service Representative for a demonstration of Oakite Composition No. 98. Or write for free descriptive booklet to Oakite Products, Inc., 26 Rector Street, New York 6, N. Y.

REMARKABLE RESULTS NOW OBTAINED BY ENTHUSIASTIC METAL FABRICATORS

Auto-maker washing blocks, cam shafts, tappets, wrist pins, transmission housings, fly wheels and other parts is delighted with the rust protection obtained.

Automotive plant turning out parts with highly finished surface reports use of Oakite Composition No. 98 not only cleans but also leaves a streak-free protective film so essential to quality control.

Metal fabricator finds that small precision steel parts are protected against rust for 3 to 4 weeks. The need for expensive fire prevention equipment—originally installed for use with low-flash rust-proofing oil—is eliminated.

Engine builder using Oakite Composition No. 98 in two-

stage washer says not only are parts well cleaned but also protected against rust at unusually low cost.

Metal parts company washing parts by machine finds Oakite Composition No. 98 completely eliminates rusting in humid weather.

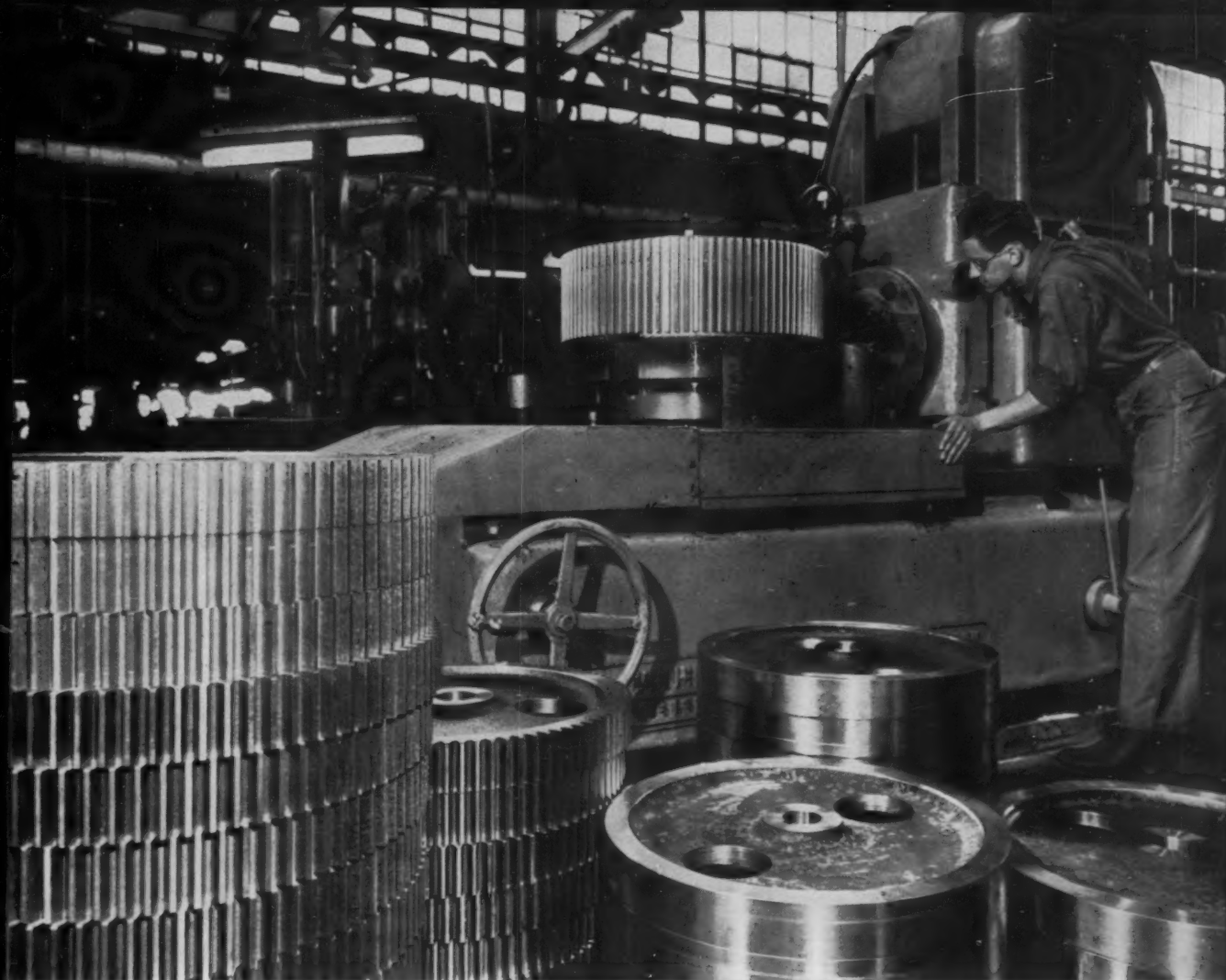
Manufacturing firm reports Oakite Composition No. 98 very economical. Parts come through clean and bright, no cloudy film—good rust protection.

Engine builder using Oakite Composition No. 98 after machining but prior to inspection and assembly expects five-day rust protection and gets it.

Technical Service Representatives in Principal Cities of U. S. and Canada



Export Division Cable Address: Oakite



They Will Stand Close Inspection

The young man at the hobbing machine is merely giving his work an appraising look. Detailed inspection will come later, and it is safe to say that the verdict will be favorable. For this is the shop of The Adams Company, Dubuque, Ia., specialists in the art of making good gears.

Each of the gears in the photograph has 86 teeth; is 22 in. in diameter and weighs 153 lb finish-machined. Each is intended for use in heavy-duty excavating equipment. Four gears are machined at one time in the hobber, though you may have to look sharply to detect all four.

The gears are made from Bethlehem circular blanks. These blanks are both forged and rolled by a unique single-step method that insures great

strength, uniform density, and regular grain flow. Blanks made by this process can be furnished in a wide variety of sections, and in sizes ranging from 10 to 42 in. OD.

Excellent for heavy-duty gears, Bethlehem blanks also have many other end uses—sheave wheels, crane wheels, flywheels, turbine rotors, pipe flanges, etc. Whether you manufacture gears or something else requiring circular blanks, we'd like the chance to send you full details. A letter, wire, or telephone call will bring the complete story to you promptly.

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.
On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation. *Export Distributor:* Bethlehem Steel Export Corporation

BETHLEHEM STEEL





MAGNESIUM *machinability beats tight schedules*

Machinability and handling ease are two reasons Carr Lane moves jobs faster, at lower cost, with magnesium tooling plate

When a job has to be completed in a hurry, which is often the case at Carr Lane Manufacturing Company, St. Louis, there are big advantages in using magnesium tooling plate.

FASTER MACHINING. Production operations go faster because magnesium jigs and fixtures are easy to machine, easy to weld. Excellent dimensional stability and precision flatness help to hold the closest tolerances. These properties also help to save many hours in the process. On the fixture illustrated, it would take twice as long to do the job in

aluminum—and ten times as long in steel.

FASTER HANDLING. The light weight of magnesium, two-thirds that of aluminum, permits pieces to be handled and moved from one operation to another with a minimum of time, effort and equipment. This is particularly important with large jigs and fixtures which couldn't be handled manually if they were made of steel.

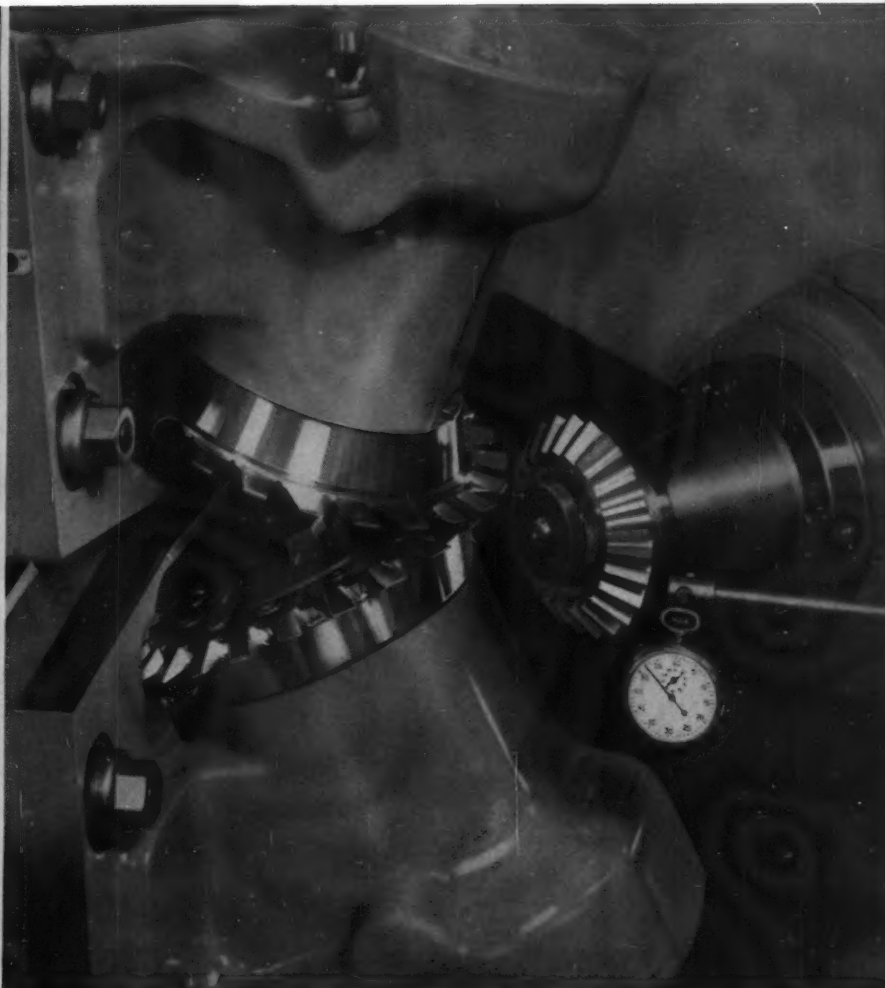
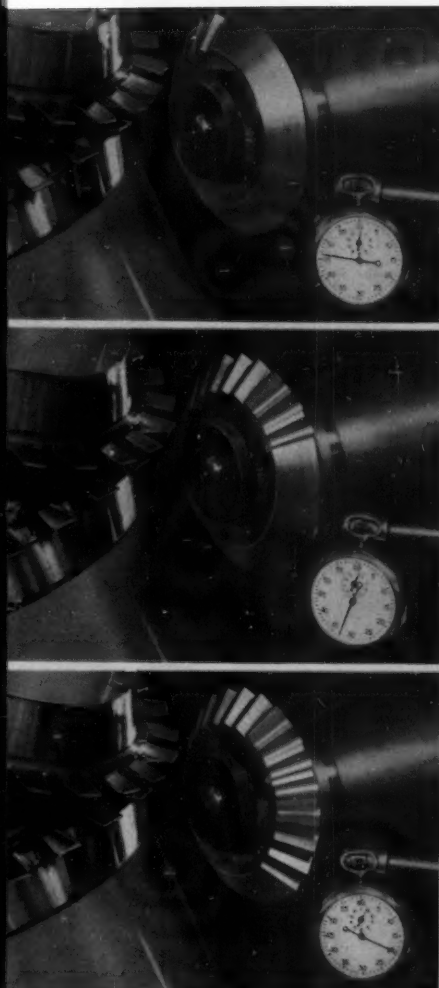
FASTER AVAILABILITY. You can get magnesium tooling plate when you want it and how you want it. Whether production deadlines are tight or not, it's always readily obtainable in any standard size and gauge from stock. Contact your nearest supplier of Dow Magnesium or write to THE DOW CHEMICAL COMPANY, Midland, Michigan, Dept. MA 372CC-1.

Available from stock at . . .

Copper and Brass Sales, Inc., Detroit, Mich. • Fullerton Steel and Wire Co., Chicago, Ill. • Hubbell Metals Inc., St. Louis, Mo. A. R. Purdy Co., Inc., Lyndhurst, N. J. • Reliance Magnesium Co., Los Angeles, Calif. • Vinson Steel and Aluminum Co., Dallas, Texas.

you can depend on DOW MAGNESIUM

DOW



3 minutes-52 seconds, completed from the solid *You can cut gears 5 times faster!*

You can increase production by as much as 400%.

Your exact gain may vary with different gears, but in most cases this new generator will complete five gears in the time earlier models cut just one. The illustrations above show a 6 DP, 25 tooth, $\frac{1}{8}$ " face width, straight bevel gear completed from the solid blank.

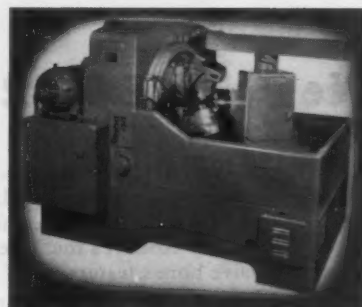
The No. 104 Straight Bevel Coniflex* Generator completes each tooth in one rapid operation. A pair of

*Coniflex® straight bevel gears with localized tooth bearings.

multi-blade disc-type cutters combined with a cam-controlled machine cycle insures high efficiency, fine finish and maximum cutter life.

Easy to set up, the No. 104 has a wide range of capacity. You'll get the same excellent results for both small quantity jobbing work and volume production.

To discover other savings you can make with this remarkable Gleason Generator, simply write for descriptive bulletin.



The Gleason No. 104 Straight Bevel Coniflex Generator cuts gears up to 8 $\frac{1}{4}$ " diameter, 4 $\frac{1}{2}$ " cone distance and 1 $\frac{3}{4}$ " face width, from 20 to 3 DP, ratios up to 10 to 1.



GLEASON WORKS

Builders of bevel gear machinery for over 90 years

1000 UNIVERSITY AVE., ROCHESTER 3, N. Y.



NILES 72" Heavy-Duty Engine Lathe: Swing over bed and carriage wings is 73½" . . . over carriage bridge, 56". Main drive accommodates 150 hp., adjustable-speed, 4:1 DC motor (with variable voltage drive optional). Speed ranges—1.35 to 101 rpm or 2.2 to 151 rpm (optional).

Metalworking News from HAMILTON!

New 72" Engine Lathe for faster set-ups,

Here's welcome metalworking news from Hamilton! An all-new 72" heavy duty engine lathe to boost your turning speeds and accuracy . . . for top machining quality at lowest cost. It's the Niles A72 Lathe with these exclusive bonus features:

Speed and load indicators on faceplate drive . . . for constant operator check on machine performance. Permits capacity loading with no danger of applying excessive overloads.

Adjustable, springloaded tailstock quill with load indicator . . . for accurate quill spring preloading to suit work piece. Cuts setup time and prevents damage to centers.

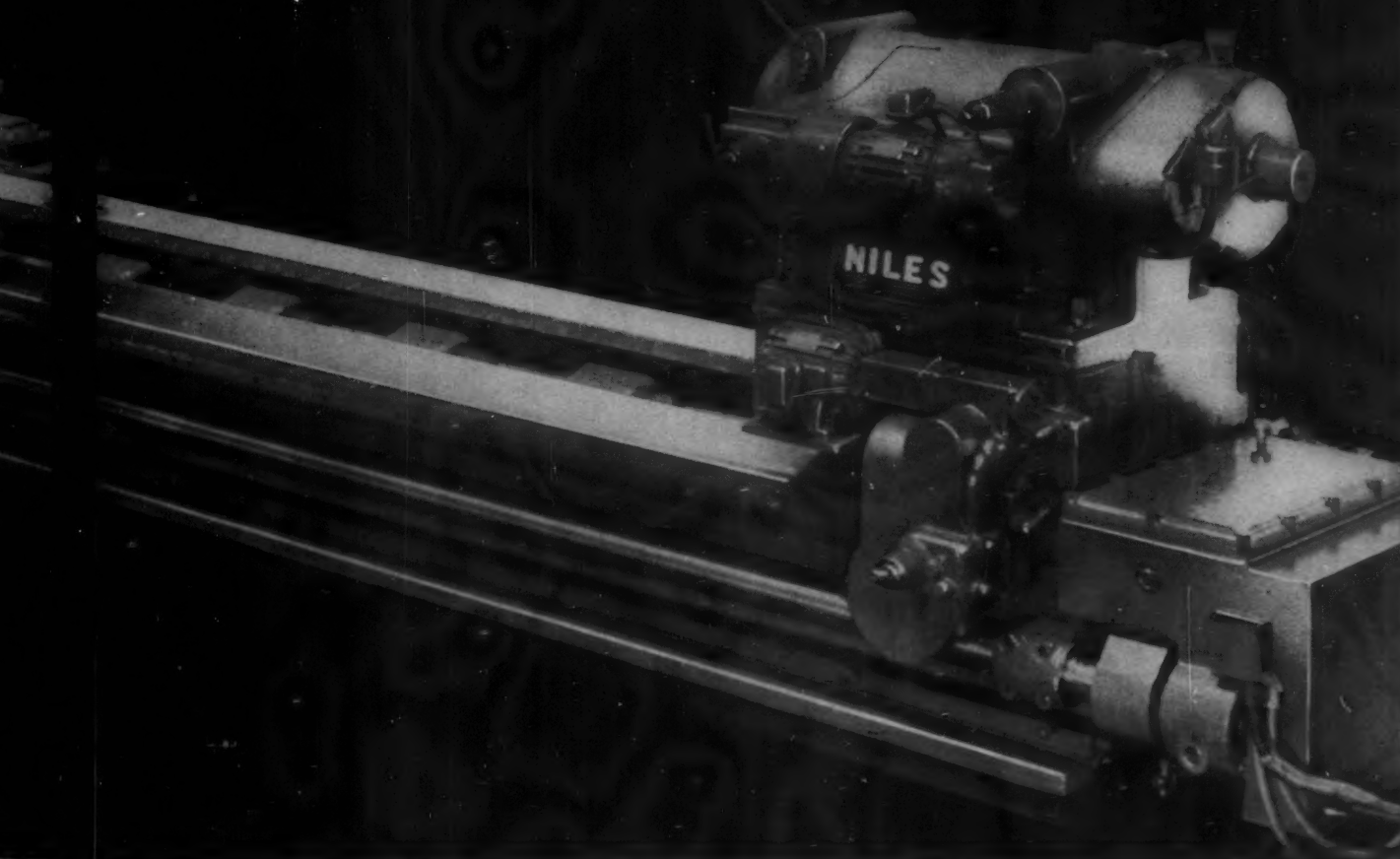
Fully enclosed leadscrew and thread selector dial . . . outmodes old-style tumbler gear selector. Eliminates opening where dust and dirt can enter to contaminate gear lubricant and foul machine operation. **Safer too!**

Hydraulic booster on faceplate speed changer . . . eliminates the heavy manual labor needed to change speeds on other large lathes.

Lubrication oil-pressure safeguard . . . prevents operating machine until positive lubrication is applied.

Optional electronic or mechanical feeds . . . with one lever selection and full pushbutton control at carriage station for either feed. Safety interlocks prevent simultaneous engagement of both. Number of feeds available: 64!

Put this new Niles A72 Lathe on *your* shop floor! You'll speed set-ups, cut machining time and slash operating costs on your heavy duty turning jobs. Easy, accurate controls make child's play of close tolerances. Get complete details on the all-new Niles A72 Lathe today. Send for new bulletin containing full specifications. Address: Dept. 9902, Hamilton Division, BLH Corporation, Hamilton, Ohio.



more accurate turning—at lowest operating cost

Look to **HAMILTON** for the engineering know-how, experience and facilities that mean outstanding performance *for you* from the full line of **NILES** Machine Tools:

NILES Heavy Engine Lathes—50", 60", 72", 84", 96" and larger

NILES Vertical Boring and Turning Mills—12', 14', 16', 30' and 43'

NILES Railroad Tools—Hydraulic Centering Machine, End Drive Axle Lathe, Hydraulic Car Wheel Lathe, Hydraulic Diesel and Car Wheel Bore, Hydraulic Axle Burnishing Lathe

HAMILTON Mechanical Presses—single, double and triple action presses for metal forming and stamping; also open back inclinable presses, rail presses, welding presses and die fitting machines



HAMILTON DIVISION

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DIVISIONS: Austin-Western • Eddystone • Hamilton
• Electronics & Instrumentation • Lima • Madsen
• Loewy-Hydropress • Pelton • Standard Steel Works

Precision Tooling

shortest route
to **COST**
REDUCTION



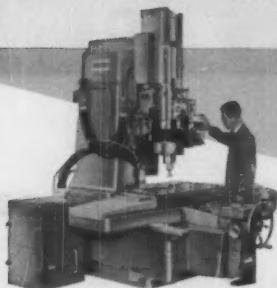
P & W

KELLER MACHINES

Producing an almost limitless variety of dies, molds, prototypes and other work, these automatic, tracer-controlled millers accurately reproduce the shape of any 2-dimensional template or 3-dimensional full model. Complex forms that cannot be machined economically — or at all — by other methods are produced quickly and easily by "Kellering."

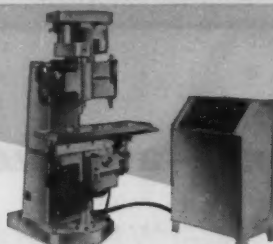
PRATT & WHITNEY COMPANY, INCORPORATED

MACHINE TOOLS • GAGES • CUTTING TOOLS



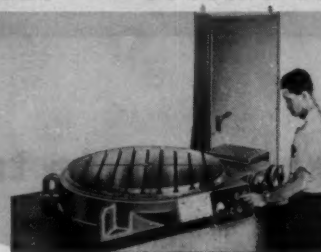
2E VERTICAL PRECISION HOLE GRINDER

"Tenths" accuracy plus grinding speeds to 100,000 rpm.



"VELVETRACE" MILLING MACHINE

Ultimate in accuracy for 3-dimensional tracer-controlled reproduction.



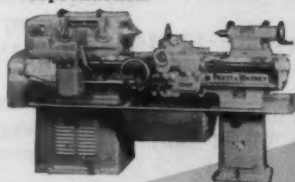
PRECISION ROTARY TABLES

Rugged, accurate to seconds! Automatic, plain, tilting and vertical types; 10" to 50" diameters.



PLAIN AND UNIVERSAL DIE SINKERS

Extra power and stamina to handle today's tougher die steels with speed, accuracy.



MODEL C LATHES

Traditionally the finest wherever highest precision is essential . . . now even better.



CUTTER and RADIUS GRINDERS

Grinds virtually every type of standard and special cutter . . . quickly and accurately.

To meet today's standards for quality and performance . . . and to compete profitably on today's markets . . . your products must be manufactured with a greater degree of precision than ever before. The only sound, economical way to meet these high standards is to build precision into your products where production starts . . . in your tool room with Pratt & Whitney Machine Tools . . . your assurance always of the finest, the most accurate.

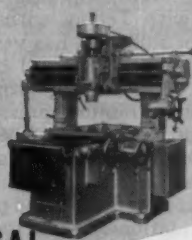
P & W

JIG BORERS

Locating, boring and checking to .0002 of an inch, P&W Jig Borers are primarily designed to bring new standards of dependable accuracy to the manufacture of basic production tools such as jigs, fixtures, dies, molds, etc. However, unequalled speed and ease of operation have led to widespread use for precision small-lot production; for fast, accurate inspection work; and for a variety of precision machining jobs where other types of machines would require complicated jigs and fixtures.

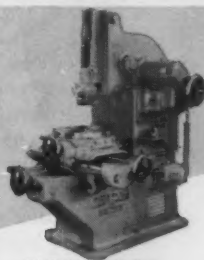
WEST HARTFORD, CONNECTICUT

Direct Factory Representatives in Principal Cities



VERTICAL MILLERS AND PROFILERS

Economical production profiling of irregular shaped parts.



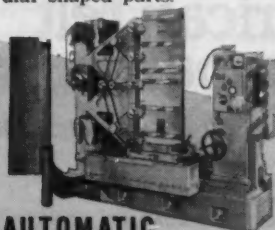
VERTICAL SHAPERS

Handiest machine in any shop for fast, accurate handling of irregular shaped work.



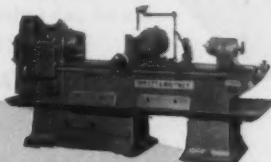
DIAFORM WHEEL FORMING ATTACHMENTS

Form-trues grinding wheels, accurate to "tenths" in minutes; saves time, money.



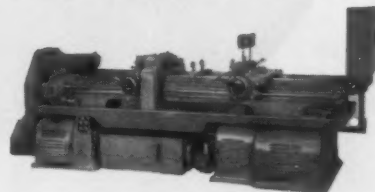
AUTOMATIC DUPLICATING MACHINES

Duplicates die and bottle mold sections . . . quickly, accurately, economically.



MODEL C THREAD MILLERS

Unusually versatile; sets new standards for accuracy, finish and economy.



DEEP HOLE DRILLERS

Twin drilling units produce true holes up to 129" deep in a single, uninterrupted operation.

A BETTER METHOD OF MACHINING

NOW!

**OUTSTANDING
CHEMICAL PROPERTIES**

**OUTSTANDING
PHYSICAL PROPERTIES**

VISTEX* with TEFLON** Gasketing Material

Another first for American! The exceptional thermal and chemical properties of Teflon are combined with low, cold flow characteristics to give you a gasketing material never before available.

**DEFINITE
ECONOMICAL ADVANTAGES**

With thermal stability up to 420F. Vistex with Teflon eliminates undesirable lateral plastic flow with excellent stability to corrosive gases, liquids and virtually all chemicals at low and high temperatures.

Vistex with Teflon, with tensile strength of 5,000 psi, has very high tear value, will not ravel or fray, has very good cutting properties. Seals with minimum pressure on polished or irregular surfaces.

American's engineering and research staff is prepared to supply you with complete data and product recommendations. Write today on your company letterhead.

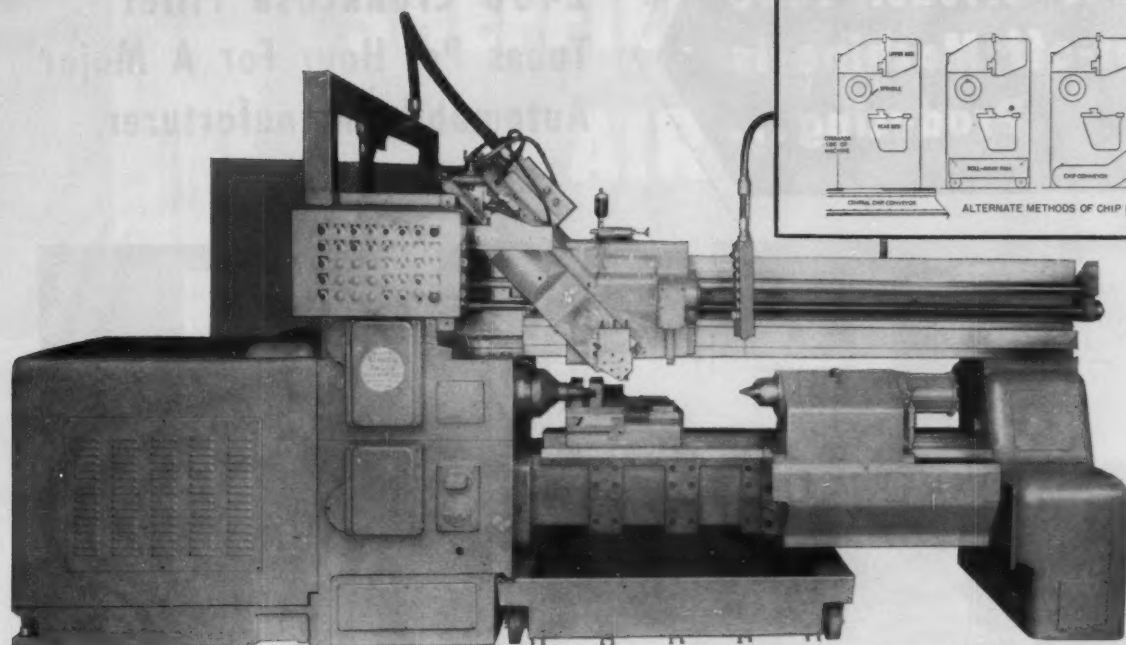
*VISTEX—Reg. Trade-mark of American Felt Company
**TEFLON—Reg. Trade-mark of DU PONT for its Tetrafluoroethylene resin.

**American Felt
Company**
TRADE MARK 

SALES OFFICES: New York, Boston, Chicago, Detroit, Cleveland, Rochester, Philadelphia, St. Louis, Atlanta, Greenville, S. C., Dallas, San Francisco, Los Angeles, Portland, San Diego, Seattle, Montreal.—PLANTS: Glenville, Conn.; Franklin, Mass.; Newburgh, N. Y.; Detroit, Mich.; Westerly, R. I.—ENGINEERING AND RESEARCH LABORATORIES: Glenville, Conn.

**GENERAL OFFICES:
68 GLENVILLE ROAD,
GLENVILLE, CONN.**

A BETTER METHOD OF MACHINING REAR AXLE, AND OTHER SHAFTS



Seneca Falls Model AQ Automatic Lathe Equipped for Flange Turning Operation on Rear Axle Shaft. 60 H. P., Net Wt. 23,000 Lbs. Also Model LQ, 30 H. P., Net Wt. 20,000 Lbs.

● The new Models LQ and AQ Seneca Falls Automatic Lathes are designed to combine the best and fastest methods of rough and finish turning shafts on a single machine without removing the work and without attention on the operator's part.

The line drawing shows a machining operation on the stem end of a rear axle shaft which is rough turned with multiple tools on a rear carriage while finish turning is done with single, tracer-controlled tools on each of the two overarm carriages. Thus the advantages of multiple tooling for stock removal and single tool tracer turning for accurate finish operations are combined. By this method extremely close tolerances are maintained since the pressure of the single tool is constant over the entire length of the work piece, and full advantage can be taken of the higher cutting speeds now possible with the newer carbide and oxide tool materials.

The machining operation is completely automatic . . . the operator loads shafts between centers and pushes the starting button; multiple tools rough turn; tracer tools then finish turn; and finally the machine stops with all tools returned to starting position.

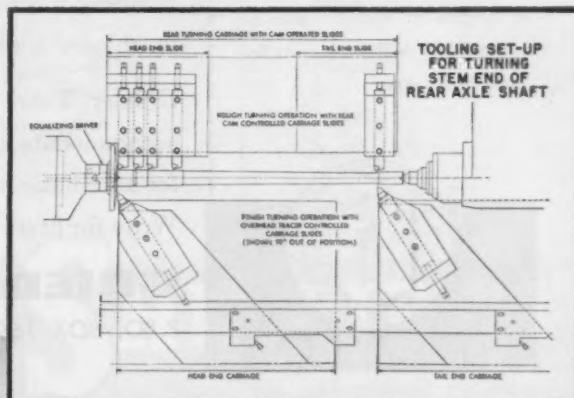
A similar type lathe is used for the flange turning operation. Varying application of multiple tooling or single tracers to either rear or overarm carriages is possible on these lathes and complete "in line" automation can be engineered to specific production requirements,

SENECA FALLS MACHINE CO., SENECA FALLS, N.Y.

Write for Bulletin Q-56-B

DESIGN FEATURES

- ▶ Simplified changeover features for reduced set-up time.
- ▶ Feed rate may be automatically changed during cutting cycle.
- ▶ Streamline design for efficient chip guarding.
- ▶ Screw feed to all carriages.
- ▶ Four speed head with automatic change-over.
- ▶ Large chip flow area.
- ▶ All templates clear of chip area.
- ▶ All ways hardened, ground and replaceable.
- ▶ Open front design facilitates loading and unloading.
- ▶ Straight line diameter adjustment for tracer tools . . . no shoulder length change to correct.



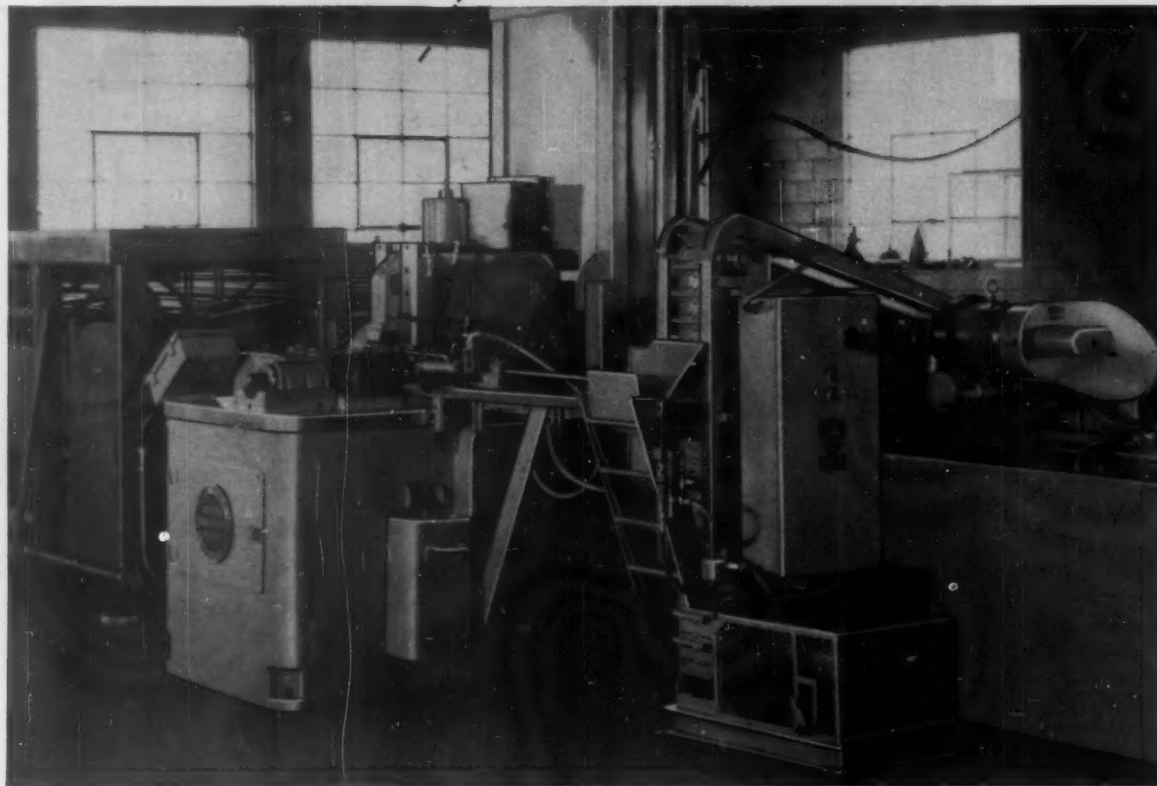
NEW SENECA FALLS

MODEL LQ AND AQ AUTOMATIC LATHES

FREE DEMONSTRATION

**One Grieder Tube
Cut-off Machine Is
Producing...**

**2400 Crankcase Filler
Tubes Per Hour For A Major
Automobile Manufacturer**



Tube Specifications

Mechanically welded $1\frac{3}{4}$ " OD, .035" wall thickness, mild steel supplied in 22' lengths. Cut off in lengths of 9.070" plus or minus .002" with both ends finished burr free.



The Grieder Tube Cut-off Machine cycling at the low end of its 4500 to 6000 pieces per hour rate runs intermittently. Production on this application is limited by the cycling rate of the special end finishing machine to which it is coupled. This complete line of machinery is electrically interlocked for automatic operation.

Grieder Tube Cut-off Machines are made in three sizes to accommodate tubes of any shape from $3/16$ " to 4" OD. Hoppers for automatic feeding of tubes are available as extra equipment.

Write for literature.

GRIEDER INDUSTRIES, INC.

P. O. BOX 169, BOWLING GREEN, OHIO

FREE DEMONSTRATION

SHEFFIELD Adjustable AIR GAGES

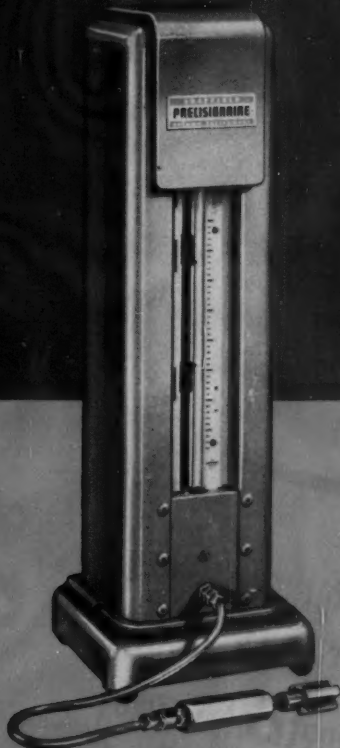
for Short Runs and Emergencies

SUCH AS:

- Aircraft manufacturers, subcontractors and job shops having limited production.
- Accidental damage to a vitally needed single purpose gage.
- An unexpected engineering change involving part size.
- A short run of special parts for which no gages have been provided.
- A mistake or failure in ordering the needed single purpose gages.

- Sudden need for process gages at the production machines.

Don't let any of these situations cause costly scrap, delays or embarrassing confusion in inspection, in the shop or in the toolroom. A small investment in the adjustable air gages here illustrated is your best insurance against unpredictable production losses. *The Sheffield Corporation, Div. #9, Dayton 1, Ohio, U.S.A.*



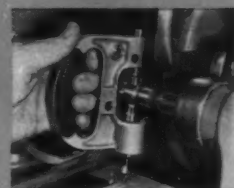
**ADJUSTABLE
BALLJET
SPINDLE KITS**
1" to 3"

In 5 minutes you can assemble, for precision gaging, a spindle for ANY SIZE hole from 1" to 3". No auxiliary equipment needed except conventional gage blocks—NOT EVEN ONE MASTER SETTING RING.



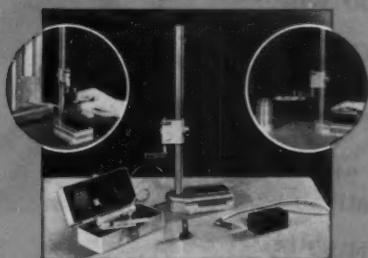
**ADJUSTABLE
AIREBORE GAGE KITS**
3" to 12"

The Airebore Gage can be set precisely to any diameter from 3" to 12" by means of a calibrator and gage blocks. No master rings are needed.



**PLUNJET ADJUSTABLE
SNAP GAGES**
0" to 12"

Twelve Plunjet Adjustable Snap Gages cover a gaging range from 0" to 12"—Larger sizes on special order.



AIRETEST AND PLUNJET STAND

This stand accommodates an Airetest Indicator—also converts to a comparator or height gage by using a Plunjet or dial indicator and anvil.

SELF-CENTERING ADJUSTABLE SPINDLES

1/2" to 3"

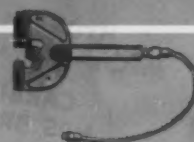
Four Self-centering Adjustable Spindles cover respectively the ranges of 1/2" to 1/4", 1/4" to 1/8", 1/8" to 1/16" and 1/16" to 1/32". All but the smallest can be set with gage blocks.



STANDARD ADJUSTABLE AIRSNAPS

1/4" to 5/16"

Available in 17 models to cover the range .2500" to 5.500". Up to 3.000" the anvil has an adjustment of 1/4"—above that, 1/2".



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manufacture and measurement for mankind

Call Your Sheffield Representative for a Demonstration in Your Plant

SIMONDS

A "natural" for
aircraft
parts

*New!
Revolutionary!*

Colonial ONE-WAY Surface Broacher

"Eliminates" Return-Stroke
"Eliminates" End of Stroke
"Doubles" Length of Stroke

For complete information on the
new Colonial ONE-WAY surface
broacher, ask for Bulletin VC-55

MECHANICAL DRIVE
AC MOTOR
VARIABLE SPEED
HYDRAULIC OR
MECHANICAL FIXTURES
CARBIDE OR
HSS BROACHES
NO PIT REQUIRED
FOR LOW CEILING
LONGER TOOL LIFE

EXTREME ACCURACY
GUARANTEED
STROKE LENGTH
UP TO 200 INCHES
SPEEDS UP TO 50 FEET/MIN.
ONE LONG STROKE—
ONE PART
OR
MULTIPLE SHORT STROKES
ON MULTIPLE PARTS
CONTINUOUS OPERATION



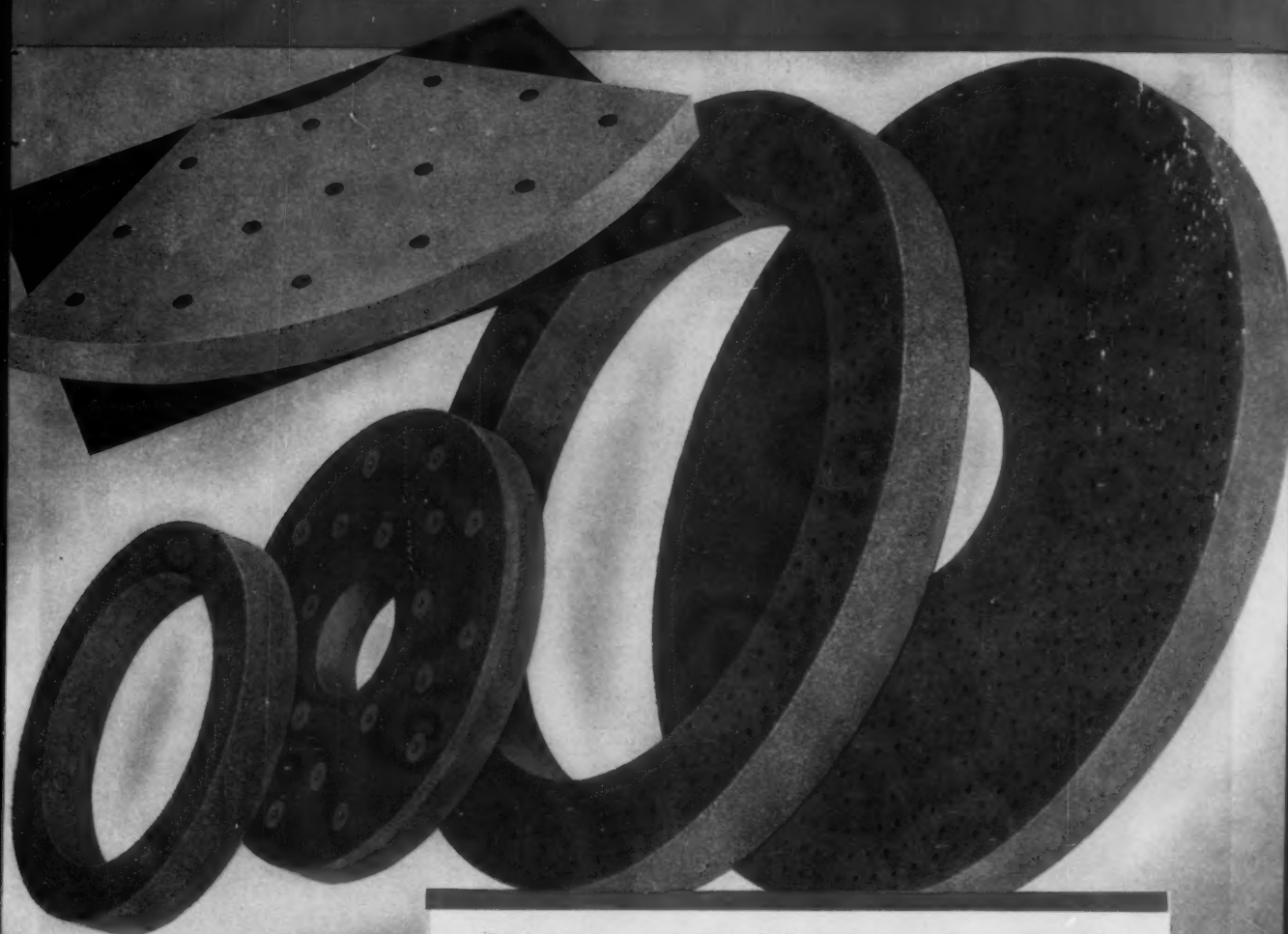
UNIFIED BROACHING is the key to successful broaching

SIMONDS
ABRASIVE CO.

Nut or bolt inserted

ABRASIVE DISCS

for faster production



Made by an outstanding grinding wheel manufacturer expressly for use on Besly, Gardner, Hanchett and similar grinders . . . furnished in grain and grade specifications specially engineered to give better, faster production . . . available in all sizes to fit all grinders, back plates and bolt hole layouts . . . supplied plain or perforated, solid or sectional, for use singly or in pairs. Only usable abrasive charged for. Send for Bulletin ESA 54.

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Branch Warehouses: Boston, Detroit, Chicago, Portland, San Francisco. Distributors in Principal Cities
Division of Simonds Saw and Steel Co., Fitchburg, Mass.

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DISTRIBUTOR**



NEW—self-locking UNBRAKO

HOW NYLOK® LOCKS:



LOCKED! The tough, resilient nylon pellet keys itself into the mating threads. It forces threads together and locks the screw securely.

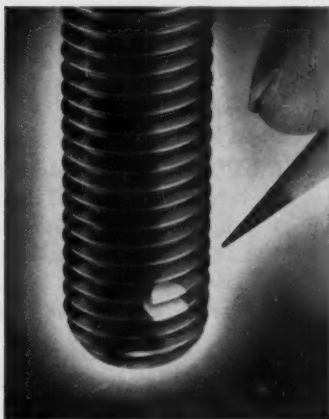
socket head cap screws



Self-locking UNBRAKO socket head cap screw.



BEFORE ASSEMBLY. The nylon pellet projects slightly. When assembled, threads will be impressed into it.



AFTER REMOVAL. "Plastic memory" of pellet has expanded impressed threads to greater diameter than screw threads. Screw can be used repeatedly. In use, "memory" keeps threads tightly locked.

They won't work loose. And they simplify design and save production time.

UNBRAKO socket head cap screws are now available embodying the Nylok* self-locking principle. Nylok provides the first truly practical solution to the problem of making cap screws self-locking.

An UNBRAKO cap screw with Nylok is a single self-locking unit. No auxiliary locking devices are needed. Just thread the UNBRAKO into any tapped hole. *Seated or not*, it locks positively wherever wrenching stops. The tough, resilient nylon pellet forces mating threads together and holds tight. The screw will not work loose.

You save production time when you make products with self-locking UNBRAKOS. And you get greater simplicity in design with less bulk and weight. The number of parts you must assemble to achieve full locking action is reduced to the absolute minimum. Lockwashers under screw heads are no longer necessary. Costly wiring of cross drilled heads is eliminated. And in many cases you will save weight and mass by using shorter screws in tapped holes instead of drilling through and using nuts and lockwashers.

Self-locking UNBRAKOS are reusable. They have uniform locking and installation torques—with no galling or seizing on mating threads. They successfully withstand temperatures from -70° to 250° F. And, when screws are properly seated, the locking pellet also functions as a liquid seal.

A complete line of self-locking UNBRAKO socket screw products, in a wide range of standard sizes, materials and finishes, is available through your authorized industrial distributor. Technical data and specifications are detailed in Bulletin 2193. Write us for your copy today. Unbrako Socket Screw Division, STANDARD PRESSED STEEL CO., Jenkintown 19, Pa.

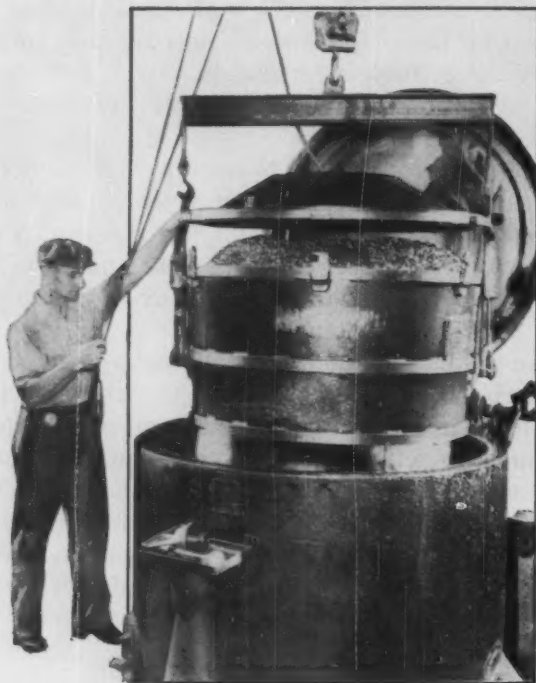
**T.M. Reg. U.S. Pat. Off., The Nylok Corporation*

UNBRAKO SOCKET SCREW DIVISION

STANDARD PRESSED STEEL CO.

SPS
JENKINTOWN PENNSYLVANIA

WHEN THE CHIPS ARE DOWN...



Every drop of cutting oil in your chips and turnings costs you money. Every drop adhering to the chips after drying, is wasted money.

De Laval Centrifugal Chip Oil Extractors salvage the maximum amount of oil. They speed up the salvaging process... operate free of gyration under normal loads... are easy to load and unload... are built to take it.

De Laval not only makes Chip Oil Extractors in various types and sizes to meet each set of conditions, but De Laval Engineers are available to advise you on every phase of chip oil reclamation, including the handling of dried chips.

Put your chip salvage up to De Laval today — as many other metal working plants have already done.



THE DE LAVAL SEPARATOR COMPANY Poughkeepsie, New York • 427 Randolph St., Chicago 6 • DE LAVAL PACIFIC CO. 201 E. Millbrae Ave., Millbrae, Calif.

A SHORT CUT TO A FINISHED PRODUCT



SAVE YOURSELF TIME AND TOOL CHARGES

with Anaconda multiple-plunger press products—in a wide choice of metals

If you need parts like these in quantity, The American Brass Company can save you time and money. Through its specialized experience—and thousands of stock tools—it may save tool charges, too.

Ferrules, grommets, eyelets, deep-drawn cups and shells, and thousands of other intricate, close-tolerance parts made from strip metal are everyday business. American Brass Company design engineers and toolmakers have earned an en-

viable reputation for cutting costs and performing the almost impossible in design and production.

Your choice of metal: Such fabricated products can be furnished in copper, brass, bronze, nickel silver, nickel, iron, steel, stainless steel, and aluminum—in a wide variety of finishes.

Standard products: For a selection of more than 1000 eyelets of common sizes and styles, as well as eye-

lets kept in stock for immediate shipment, write for Catalog BG-1.

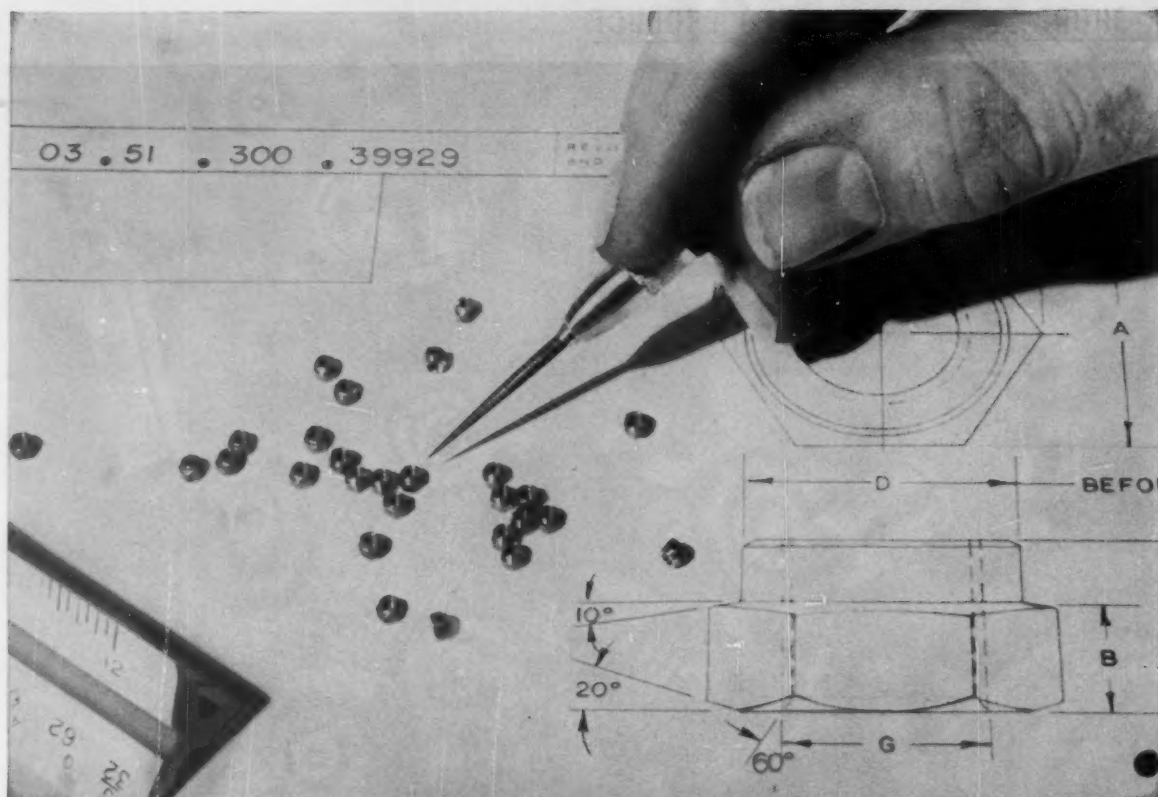
Special products: Just send a sample, drawing, or description, together with the quantity you need, the metal to be used, and other pertinent information. Address: The American Brass Company, Fabricated Metal Goods Division, Waterbury 20, Conn.

5508 (Rev.)

ANACONDA
MULTIPLE-PLUNGER PRESS PRODUCTS

For more information fill in page number on Inquiry Card, on page 275

MACHINERY, November, 1956—135



FLEXLOC MICROSIZE locknuts meet designers' needs for tiny precision nuts that retain strength and holding power in the smallest assemblies—servomechanisms, electronic and electrical equipment, all miniature devices.

New FLEXLOC Microsize Locknuts

Now available in Alloy Steel, Stainless Steel, Brass and Aluminum for lighter, more compact designs

SIZE	Across Flats		Shoulder Height		Across Corners	Height
	MAX.	MIN.	MAX.	MIN.	MIN.	+.000 -.003
0-80 NF-3B	.111	.107	.047	.042	.123	.075
1-64 NC-3B	.127	.123	.0635	.0585	.141	.090
1-72 NF-3B	.127	.123	.0635	.0585	.141	.090
2-56 NC-3B	.158	.153	.068	.063	.176	.105
2-64 NF-3B	.158	.153	.068	.063	.176	.105
3-48 NC-3B	.190	.183	.071	.066	.210	.120
3-56 NF-3B	.190	.183	.071	.066	.210	.120
4-40 NC-3B	.190	.183	.072	.067	.210	.120
4-48 NF-3B	.190	.183	.072	.067	.210	.120

SPECIFICATIONS: Available in brass (plain or cadmium plated) and aluminum (plain or chemically treated), for temperatures to 250°F; alloy steel, 18-8 stainless, for temperatures to 550°F.



New FLEXLOC Microsize locknuts are smaller and lighter than regular FLEXLOCs of the same nominal diameter. Wrenches of smaller size are used to install them. Mating joints or flanges can be designed smaller—with no loss in strength or convenience of assembly.

Microsize FLEXLOCs have all the advantages of larger FLEXLOCs. One-piece, all-metal construction—nothing to put together, come apart, lose or forget. Use them as lock or stop nuts—they stay put anywhere on a threaded member as soon as the locking threads are fully engaged. Uniform locking torques insure accurate preloading. There are no nonmetallic inserts to pop out or deteriorate. Moisture, dryness, oil won't affect these Microsize FLEXLOCs. Just screw them on. They lock and stay locked. Vibration won't shake them loose.

For complete information on Microsize FLEXLOCs, consult your authorized SPS distributor. Or write STANDARD PRESSED STEEL CO., Jenkintown 19, Pa.

STANDARD PRESSED STEEL CO.

FLEXLOC LOCKNUT DIVISION

SPS

JENKINTOWN PENNSYLVANIA

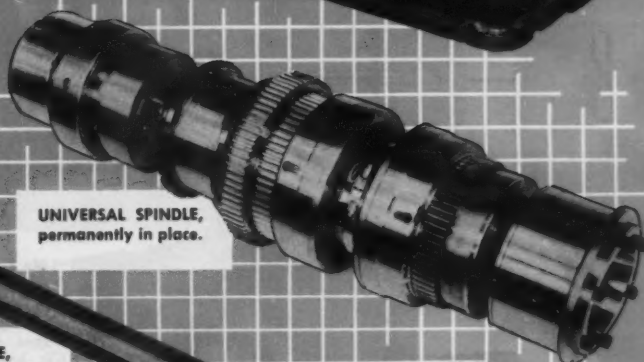
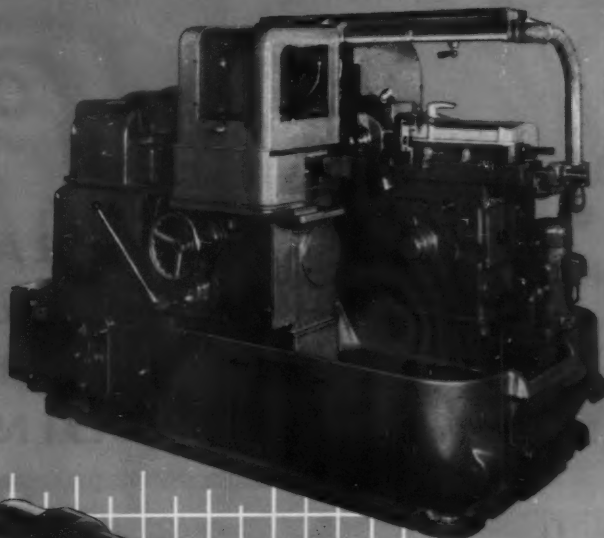
TAREX AUTOMATICS

... here's JUST ONE of the salient features of this machine which is made with SWISS PRECISION throughout:



The ability to change from BAR work to a CHUCKING machine

*in **1** HOUR!*



UNIVERSAL SPINDLE,
permanently in place.



BAR SPINDLE,
mounted in Universal.

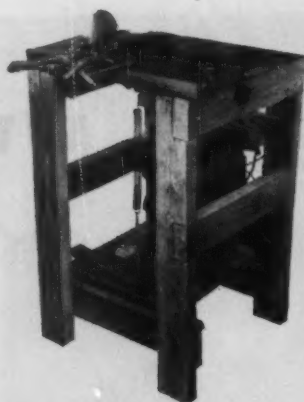
CHUCKING SPINDLE
(Mechanical or Air),
replacing Bar Spindle.

COMPLETE TOOLING
and SERVICE in AMERICA.

RUSSELL, HOLBROOK & HENDERSON, INC.

292 Madison Avenue, New York 17, N. Y.

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First experimental multi-spot welder model developed in 1901 for welding fan blades to hubs.

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FIRST IN RESISTANCE WELDING



Modern refrigerator wire condenser coil welder which makes 272 welds of wire to tubing with each stroke at 40 spm. Mechanically operated, it has a common drive for weld press, conveyor and shear.

Federal Resistance Welder experience dates back to the very beginning of resistance welding. From that day to this, Federal has remained "First in Resistance Welding" engineering, design and development.



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5

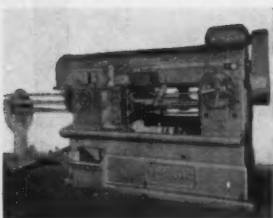


First with NEW "Automatic" Service

Cone was the first builder of multiple spindle automatics to provide machine users with an experimental service in the application of carbide tools.

This service is a practical means of determining the possibilities of carbide tools for production men without loss or interference with their regular production schedules.

A pamphlet "FOUR STEPS WITH CONE" describes this service. Send for your free copy.



Conomatic

CONE AUTOMATIC MACHINE COMPANY, INC., WINDSOR, VT., U. S. A.

the finest high production lathes

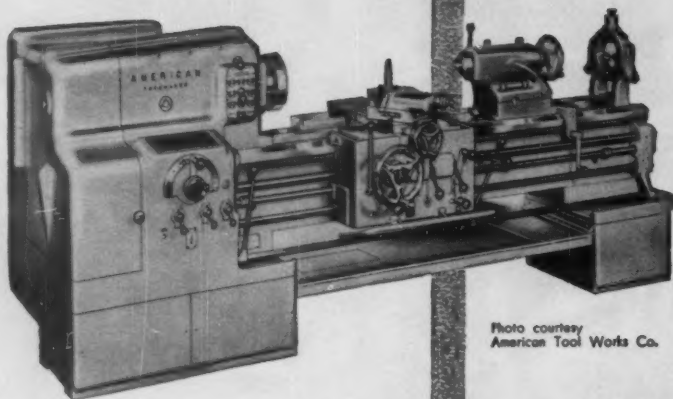
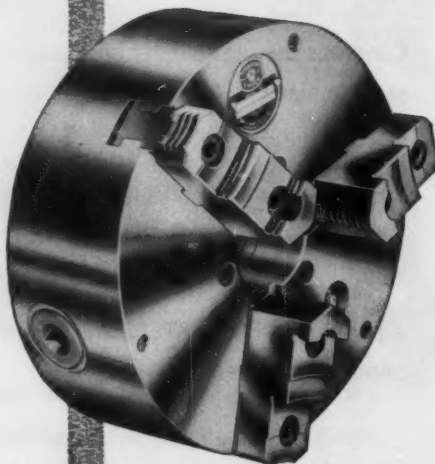


Photo courtesy
American Tool Works Co.

Here is the new 16" Deluxe Model "AMERICAN" Pacemaker Lathe. This new design places particular emphasis upon the factors of power, stamina, dependability, precision, accuracy and ease of operation required for both production and tool room service. For complete data write for Bulletin No. 116, The American Tool Works Co., Cincinnati 2, Ohio.

deserve the finest high production chucks

This is Horton's 3-Jaw Scroll Universal Chuck which for more than 100 years has been the companion to the world's finest lathes. Its lasting accuracy and precision contribute to the high production of any tool room or plant. For the complete story on this and Horton's complete line of high production chucks, see the Horton people in your area now.

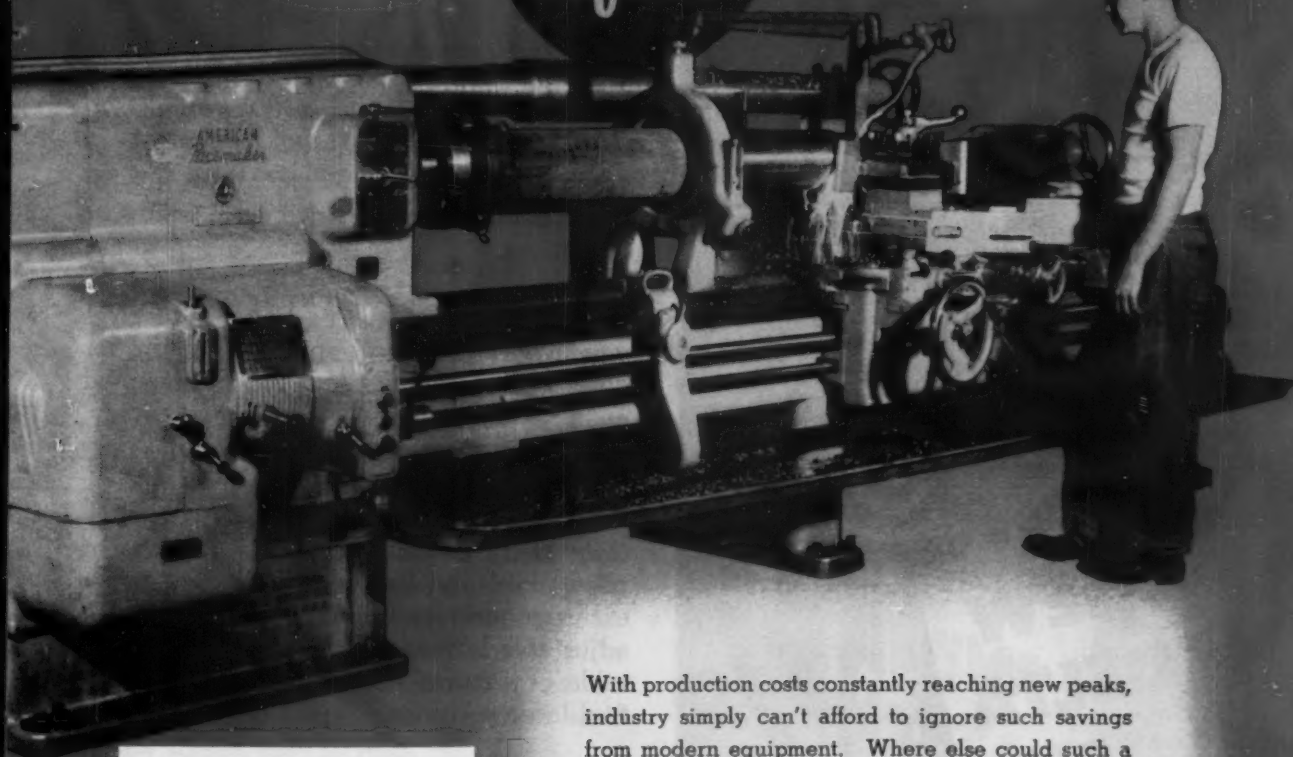


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With production costs constantly reaching new peaks, industry simply can't afford to ignore such savings from modern equipment. Where else could such a magnificent return upon an investment be secured, and how else can costs be lowered to meet an increasingly competitive market?

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Put your payroll dollar to work for greater profits with "AMERICAN".

Bulletin No. 35 shows many examples—it's yours for the asking.

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ROCKWELL-BUILT **TWO NEW DELTA**

ALL NEW DELTA 15"

World's most versatile

*drill press for all-around shop use—extra
rugged for production work!*

WORLD'S MOST COMPLETE LINE—Choose from the world's widest range of models for every production and shop need: floor, bench, multiple-spindle set-ups—production or standard table—plus a complete line of components for adapting to special-purpose operations.

AMAZING VERSATILITY—Only Delta gives you a selection of six spindle adaptors for dozens of operations. And they're mounted on a ground taper for *complete* accuracy, feature a threaded collar for *positive* locking.

EXCLUSIVE "UNIVERSAL" HAND FEED—Only Delta combines the best features of pilot wheel and single lever feeds with an exclusive universal hand feed. Gives you adjustable leverage—freedom from striking table or fixtures—almost infinite choice of feed lever positions.

BUILT FOR PRODUCTION WORK—Spindle has four over-sized, pre-loaded, lubricated-for-life ball bearings for *extra* ruggedness. Big 2" dia. quill and massive one-piece head casting provide greater rigidity. Multiple-spline "floating drive" minimizes vibration, assures smoother operation.



another product by
ROCKWELL



DRILL PRESSES!

GREAT NEW DELTA 20"

**Designed for production tooling—
a big-capacity, heavy-duty drill press
that's built to last!**

BIG CAPACITY—You get full 6" spindle travel with 5½' high column for additional spindle-to-table capacity. Choose from a complete line: floor, bench, multiple-spindle models—production or standard table—No. 2 or No. 3 Morse Taper Spindle.

RUGGED, ACCURATE—Double row, pre-loaded heavy-duty ball bearing close to the work load eliminates spindle play, assures years of lasting accuracy. Big 3¾" dia. centrifugally cast iron column with ½" thick wall is precision ground to size to give rigid backbone to machine, and extra weight for smooth, efficient operation.

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See the great new Delta 15" and 20" Drill presses—compare with any others, *then make up your own mind!* Your Delta Dealer is listed under "TOOLS" in the Yellow Pages of your phone book.

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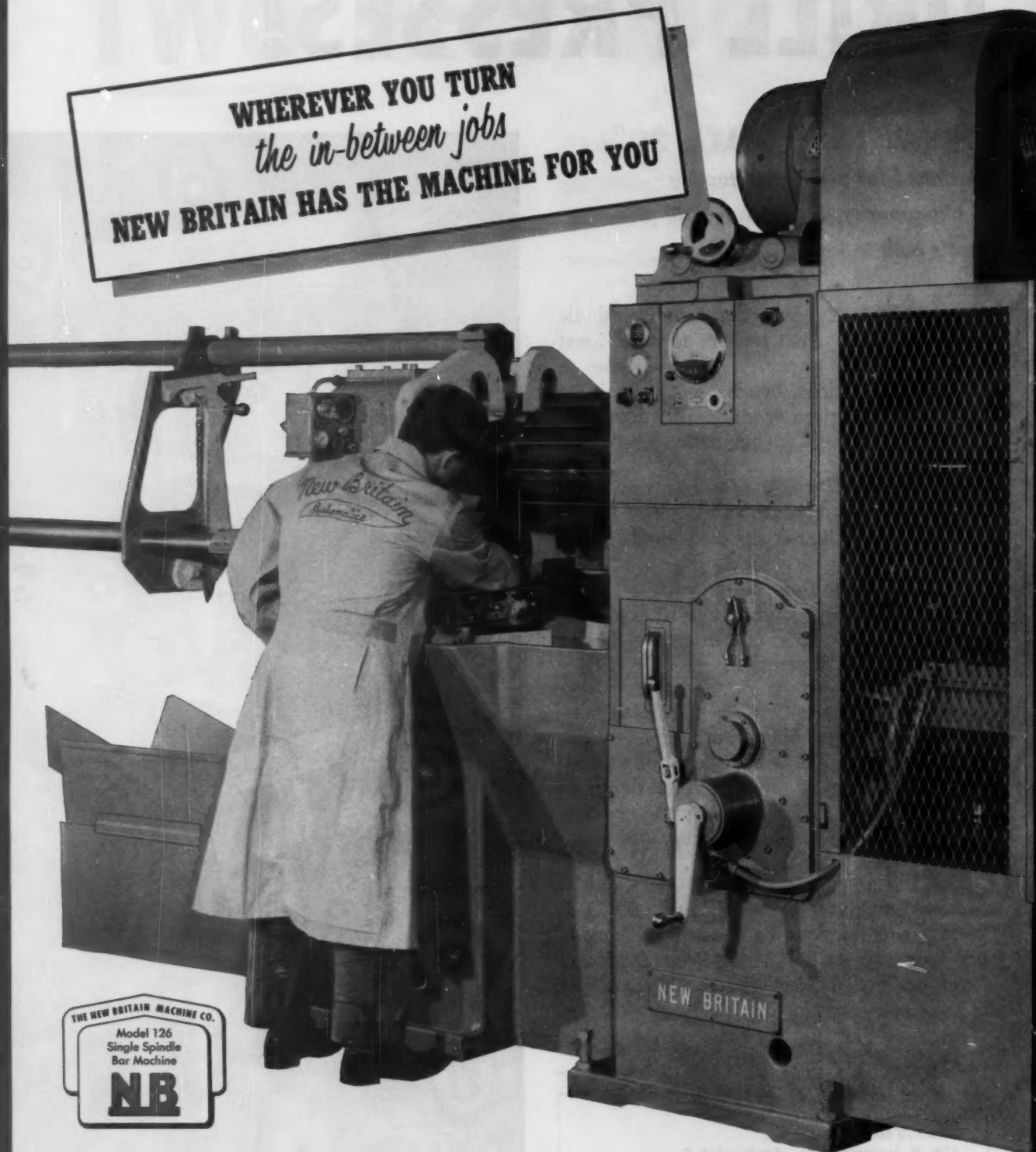
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WHEREVER YOU TURN
the in-between jobs
NEW BRITAIN HAS THE MACHINE FOR YOU

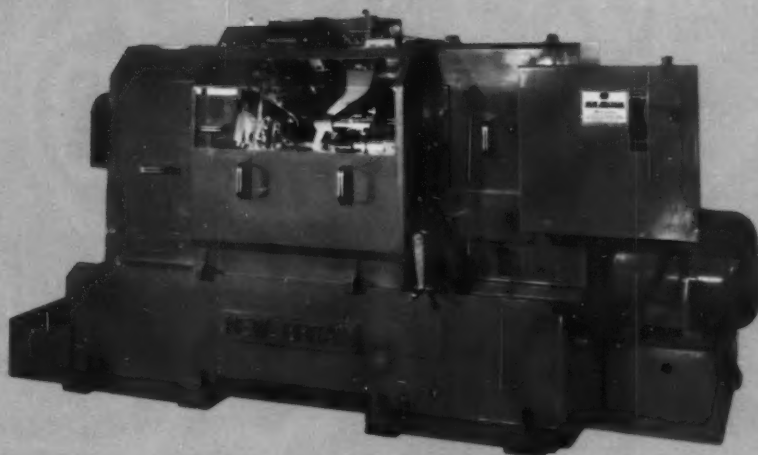


In the big borderline area of production between hand screw machines and multiple spindle types, the Model 126 New Britain single spindle bar machine can make money for you. It's rugged, fast and highly accurate. It requires minimum set-up time for tool changes, cross slide cam settings and positioning of operational sequences on the central program drum. Capacity 2 $\frac{3}{8}$ ". May we mail you more details?

WHEREVER YOU TURN
on multi-spindle bar machines
NEW BRITAIN HAS THE MACHINE FOR YOU



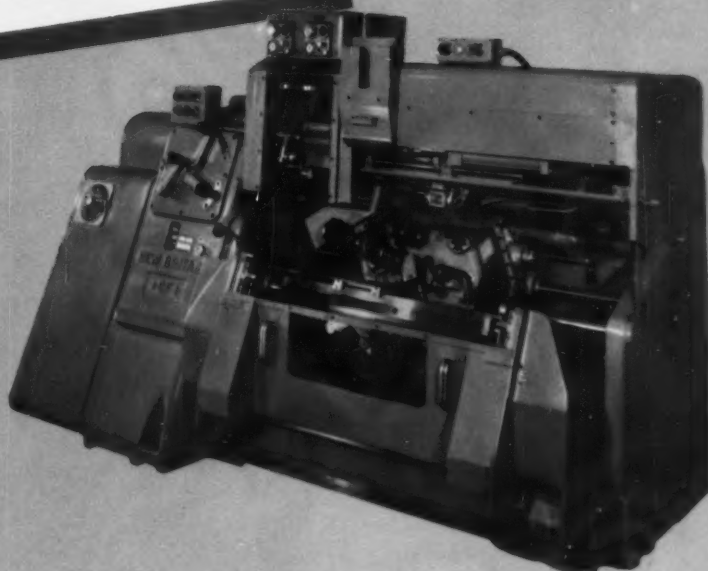
The new Model 62 New Britain bar machine has an independent radial cross slide in every position — opening new possibilities for effective tooling. New Britain "accuracy features" include spindle carrier lifting to eliminate wear during index, plus rigid locking of the carrier during the cutting cycle. Magazine loading available if desired.



WHEREVER YOU TURN
long or short runs
NEW BRITAIN HAS THE MACHINE FOR YOU



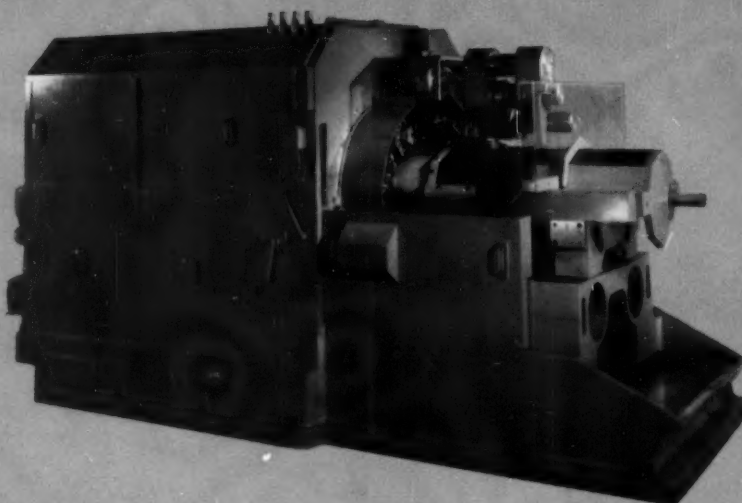
The original New Britain +6F+ copying lathe has grown into an extensive line, to meet the demand for the wide variety of applications for its better copy-turning principle. Regardless of length of run or the variety of pieces you make, you can use the New Britain +6F+ profitably. Basic advantages are: fast setup, inexpensive tooling, elimination of the chip problem, minimum operator fatigue, and dimensional accuracy with good surface finish to reduce grinding allowances. Optional features include automatic re-cycling, automatic loading and ejecting.



WHEREVER YOU TURN
castings, forgings or pressed metal pieces
NEW BRITAIN HAS THE MACHINE FOR YOU



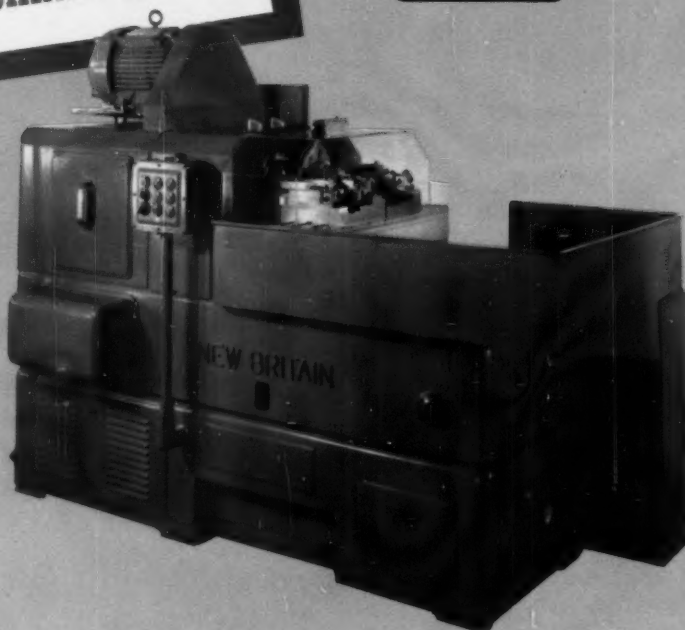
Versatility, accessibility, quick setup and sustained high production of precision parts are what you look for in an automatic chucker. New Britains are famous for these features all over the world. Perhaps you are also thinking of the possible savings which automatic loading, unloading and automatic gauging could effect. If so, you will want to learn about the imaginative use of automated production which New Britain engineers are applying to chucker work these days. You can now handle bigger pieces than ever on New Britains too — up to fifteen inches in diameter.



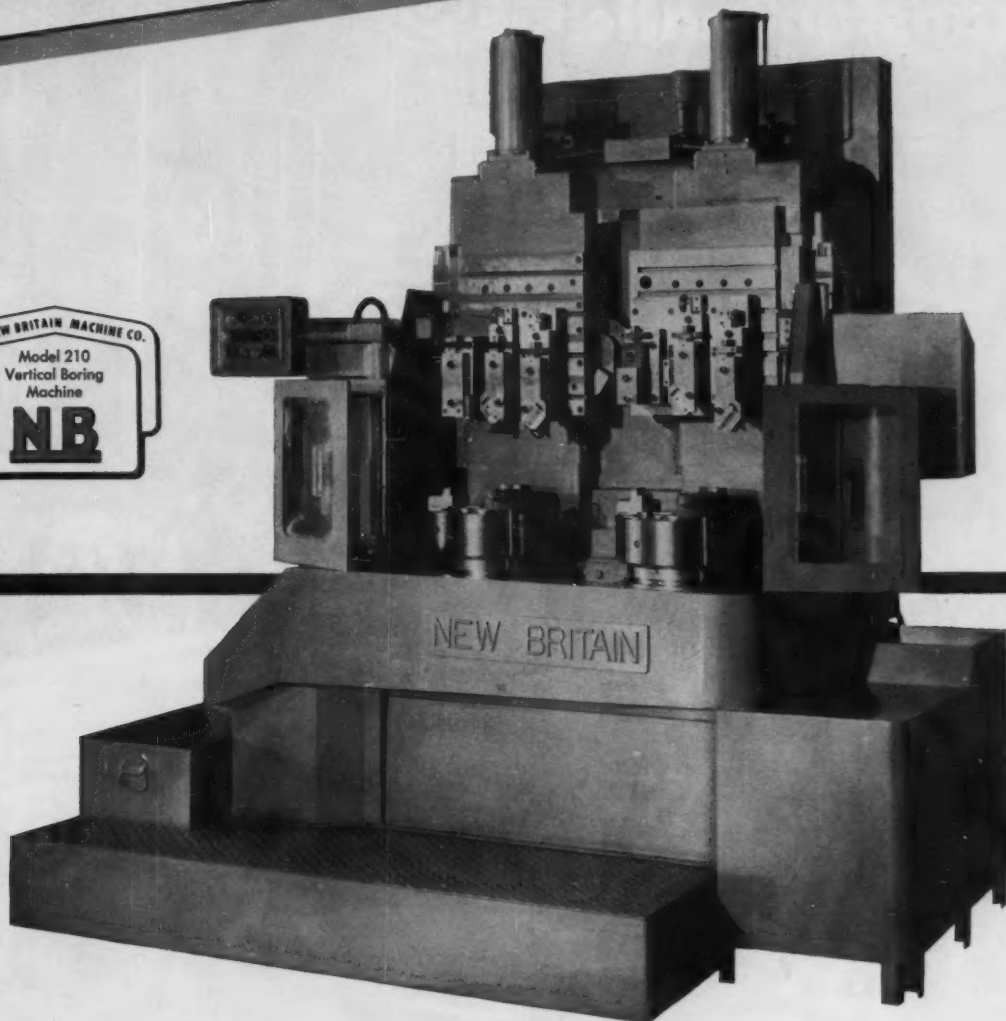
WHEREVER YOU TURN
or bore precision contour work
NEW BRITAIN HAS THE MACHINE FOR YOU



New Britain precision straight and contour boring machines provide a new approach to machining parts that would be problem pieces on any other type of equipment. These simple, fast, accurate machines require minimum attention and utilize inexpensive single point tools. They make the most profitable use of automatic loading, gauging and tool adjustment where these features fit the job requirements. The New Britain Machine Company, New Britain-Gridley Machine Division, New Britain, Connecticut.



WHEREVER YOU TURN
or bore large, heavy pieces
NEW BRITAIN HAS THE MACHINE FOR YOU



Accurate cam control of tool paths is the essential to precision contour boring. The Model 210 New Britain precision *vertical* boring machine extends the speed, accuracy and fine finish of precision straight and contour boring and turning to a wider variety of work pieces. Perhaps this is the answer to excessive costs on some of *your* work.

NEW BRITAIN-GRIDLEY MACHINE DIVISION

The New Britain Machine Company • New Britain, Connecticut

OTHER NEW BRITAIN MACHINE TOOL DIVISIONS

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Cleveland, Ohio

Precision Horizontal Boring, Drilling and Milling Machines

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Saginaw, Michigan

Multiple Spindle Precision Finishing Machines

For more information fill in page number on Inquiry Card, on page 275

MACHINERY, November, 1956—145

Announcing
**the NEW Cross
Chucking
Transfer-matic**

Pat. No. 2,745,167



Station 1



Station 4

Another Automation First by Cross



A completely new development! That's the Cross Chucking Transfer-matic... the first chucker ever built on this principle. Standard Cross "building block" construction makes provision for any reasonable number of stations and work pieces up to 48" in diameter. This particular seven station Transfer-Matic, created for differential gear cases, has a rated capacity of 368 pieces per hour at 100% efficiency.

An unusual feature is that the work pieces are chucked and not released until all operations are complete. The chucks are mounted on precision spindles, which in turn are carried on pallets—four to the pallet. There are ten pallets—one at each station and three on the conveyor moving from Station 7 to Station 1.

Operations are: Station 1, four pieces positioned in work holding chucks by loading mechanism and clamped automatically. Station 2, pilot diameters turned and side gear pockets bored. Station 3, spherical seats generated. Station 4, flange faces and thrust faces for side gears generated. Station 5, pin hole for pinion shaft drilled after spindles are indexed into pre-determined position and locked to prevent rotation. Station 6, pin hole chamfered top and bottom. Station 7, pin hole rough and finish reamed with shuttle head.

Features include construction to JIC Standards, hardened and ground ways, interchangeability of all parts, pre-set tooling and programmed tool changes with the Cross Machine Control Unit.

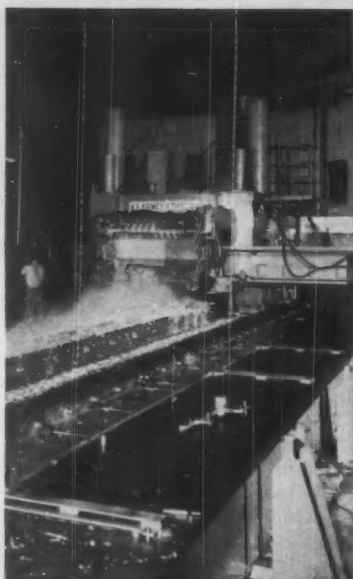
Established 1898

THE **CROSS** CO.

First in Automation
DETROIT 7, MICHIGAN



NEW Lockheed C-130 Hercules Prop-Jet transports in production at Air Force Plant No. 6, Marietta, Georgia — the world's largest integrated aircraft plant under one roof. It is operated for the U.S. Air Force by Lockheed Aircraft Corporation, which also builds and modifies B-47 jet bombers here. The Hercules is designed to take off in 12 seconds with a 20-ton load. Using unpaved airstrips, it can airlift 64 paratroopers or 92 infantrymen; converts quickly to a 74-litter hospital plane.



Combination spar and skin miller operating in Lockheed plant. *Texaco Soluble Oil* emulsions are used exclusively in these operations.

How Lockheed keeps production on schedule and reduces costs

TO KEEP its metalworking operations on schedule and its costs in line, Lockheed uses *Texaco Cutting, Grinding and Soluble Oils* at its Marietta plant. For example —

Texaco Soluble Oil emulsions are used on all spar and skin milling operations. The resulting improved performance of the millers (even at cutting speeds above 5,000 s.f.p.m.), the greater cleanliness, the substantially longer tool life—all add up to on-schedule production and lower unit costs.

There is a complete line of *Texaco Cutting, Grinding and Soluble Oils* to help you do all your machining better, faster and at lower cost. A *Texaco Lubrication Engineer* will gladly help you select the proper ones.

Just call the nearest of the more than 2,000 *Texaco Distributing Plants* in the 48 States, or write:

☆ ☆ ☆

The Texas Company, 135 East 42nd Street, New York 17, N. Y.



TEXACO Lubricants, Fuels and Lubrication Engineering Service

- Capital Equipment Market Improves
- Defense Spending Up
- Tax Reduction Hopes Fade
- Self-Triggering Tool Orders Signed
- Machinery Sales Gain



Keeping up with Washington

By Loring F. Overman

LAST May's forecast in this column was that 1956 expenditures for plant and equipment would reach \$35,000,000,000. Latest figures from the Securities and Exchange Commission indicate that third-quarter expenditures were at an annual rate of \$36,260,000,000 and that fourth-quarter outlay is expected to be at an annual rate of \$38,000,000,000. Estimated total for the year is now \$35,390,000,000—a healthy gain in which the machinery industries will share generously.

Higher prices for materials and labor are responsible for much of the increase, but an upturn of at least 20 per cent over 1955 in physical volume is expected.

Defense Spending Up

1957 Midyear Budget Review (Bureau of the Budget) contains information that will be received with mixed emotion. The good news—an immediate prospect—is that the military, always a good customer of metalworking and machine tools, is in the market again. The bad news—its impact to come later—is that the downtrend in government spending is probably at an end. This, in turn, means upward pressure on taxes.

Tax Reduction Hopes Fade

Although the platforms of both political parties promise tax reduction, the arithmetic of the situation is not favorable. The Budget Bureau's Midyear Review estimates federal expenditures for fiscal 1957 at \$69,100,000,000—\$4,000,000,000 above preliminary forecasts made last January. The same authority places 1957 receipts at \$69,800,000,000—only \$700,000,000 above expenditures. During the last session of Congress, an actual surplus of \$1,800,000,000 was considered too small to warrant an income tax cut.

Proponents of Hoover Commission economies point out that delay in putting the complete program into effect costs taxpayers \$15,120,000 each day. If the estimated annual saving of \$5,500,000,000 could be fully realized, it would permit an 8 per cent over-all tax cut, or a 15 per cent reduction if applied entirely to personal income taxes.

Businessmen may wish to ask senators and congressmen to investigate the Hoover Commission proposals. Approximately half of the recommendations require legislative action; while the other half involve administrative action.

Self-Triggering Tool Orders Signed

Office of Defense Mobilization contracts for phantom orders covering \$250,000,000 worth of machine tools were submitted in September to seventy companies. These contracts—authorizing contingent orders on which production could be started at once in the event of an emergency—call for delivery within six months. Contracts activated this year will remain in force until 1963.

Involved are 15,000 units of the following types: boring, broaching, drilling, gear-cutting, and gear-finishing machines; lathes, planers, grinding machines, milling machines, and miscellaneous general-purpose machine tools; bending and forming machines; manual, mechanical, hydraulic and pneumatic presses; punching and shearing machines; and forging machinery and hammers.

Machinery Sales Gain

Shipments of metalworking machinery during second quarter of 1956 were valued at \$289,127,000 compared with \$207,609,000 for the same period of 1955. As of June 30, 1956, unfilled orders for cutting type machines approximated \$586,000,000, and for forming and shaping types, \$295,937,000.

Washington Briefs

- Export-Import Bank has granted \$50,000,000 credit to assist some fifty American machinery manufacturers to sell equipment to a French company (SIMCA) which produces automobiles, trucks, tractors, and related parts.
- Reclaiming anti-friction bearings in a manner more profitable to the government is the object of a new study by the Defense Department and the General Services Administration.
- Business and Defense Services Administration reports a marked increase in the number of requests for priorities assistance in obtaining scarce materials for defense production. BDSA has limited such aid to direct defense contractors and a few specified defense-supporting contractors. Granting of other requests, BDSA says, would virtually precipitate demand for a return of the Controlled Materials System.
- Small Business Administration is conducting another series of meetings to acquaint small manufacturers with defense requirements.

HARDINGE
ELMIRA, N.Y.

Variable Speed Machine
for
PRODUCTION DEPARTMENTS

**Produce More Precision Parts at
Lower Cost with this
NEW Second Operation
Machine**



**Send for Free illustrated
Bulletin DSM59**

HARDINGE BROTHERS, INC., ELMIRA, N. Y. U.S.A.

Export Office: 269 Lafayette St., New York 12, N. Y. Offices in Principal Cities

Automobile Industry Ready for Another Big Year

AUTOMOBILE manufacturers are expecting 1957 to be at least their second biggest year—perhaps even their biggest. They have carefully analyzed the potential markets and laid out production programs in accordance with their findings. Before this month is over, the general public will have had the opportunity of seeing the new models that have been designed to whet every driver's appetite.

Completely restyled cars and manufacturing improvement programs costing many millions of dollars have been the automobile industry's answer to the sagging sales of this year. Extensive increases in plant facilities, the adoption of improved manufacturing techniques, and the installation of a great deal of new production equipment demonstrate the faith of the automobile companies in both an immediate and a long-range expanding national economy.

The automobile industry has always been noted for the efficiency of its manufacturing methods, but this Annual Automotive Production number of MACHINERY describes outstanding manufacturing techniques that have recently been adopted for producing high-quality parts at even lower costs than in past years.

The leading article gives details about a new process—the shell-mold casting of crankshafts. Highlights of the Chrysler Corporation's ultra-modern automatic transmission plant are presented in another article. The application of automation to the assembly of various units for Ford automobiles comprises the subject of still another article. Described also are a transfer press that completes 1000 air cleaner shells per hour and operations in a shock absorber plant that uses up forty miles of tubing per day.

Although the articles in the special section feature operations in plants of the automobile industry, many of the techniques described are applicable to other types of metalworking plants.

Charles O. Herb

EDITOR



3 kinds of help on sheet and strip steel

Sheet and strip buyers tell us that three kinds of purchasing help keep them coming back to Ryerson:

1. WIDER SELECTION OF TYPES—More than 20 kinds of sheet and coil stock are on hand in an unusually wide range of gauges—making it easier to get the exact steel needed for any requirement.

2. GREATER PROCESSING CAPACITY—The most extensive cutting and processing facilities in the steel-service industry enable buyers to get quickest service on requirements for special sizes, strip and sketch cutting, blanks, slit coils, edging, or any other processing.

3. HELP ON SHEET AND STRIP PROBLEMS—The large Ryerson staff of sheet and strip specialists gives buyers a valuable source of help in selecting the most satisfactory and economical stock—or in solving any other problem of application and fabrication.

In addition, sheet and strip buyers like the good packaging, the dependable weight and on-schedule delivery that they get from Ryerson—and the convenience of one-order buying of all steel products from the same source. So call your nearby Ryerson plant for 3-way help on sheet and strip needs.

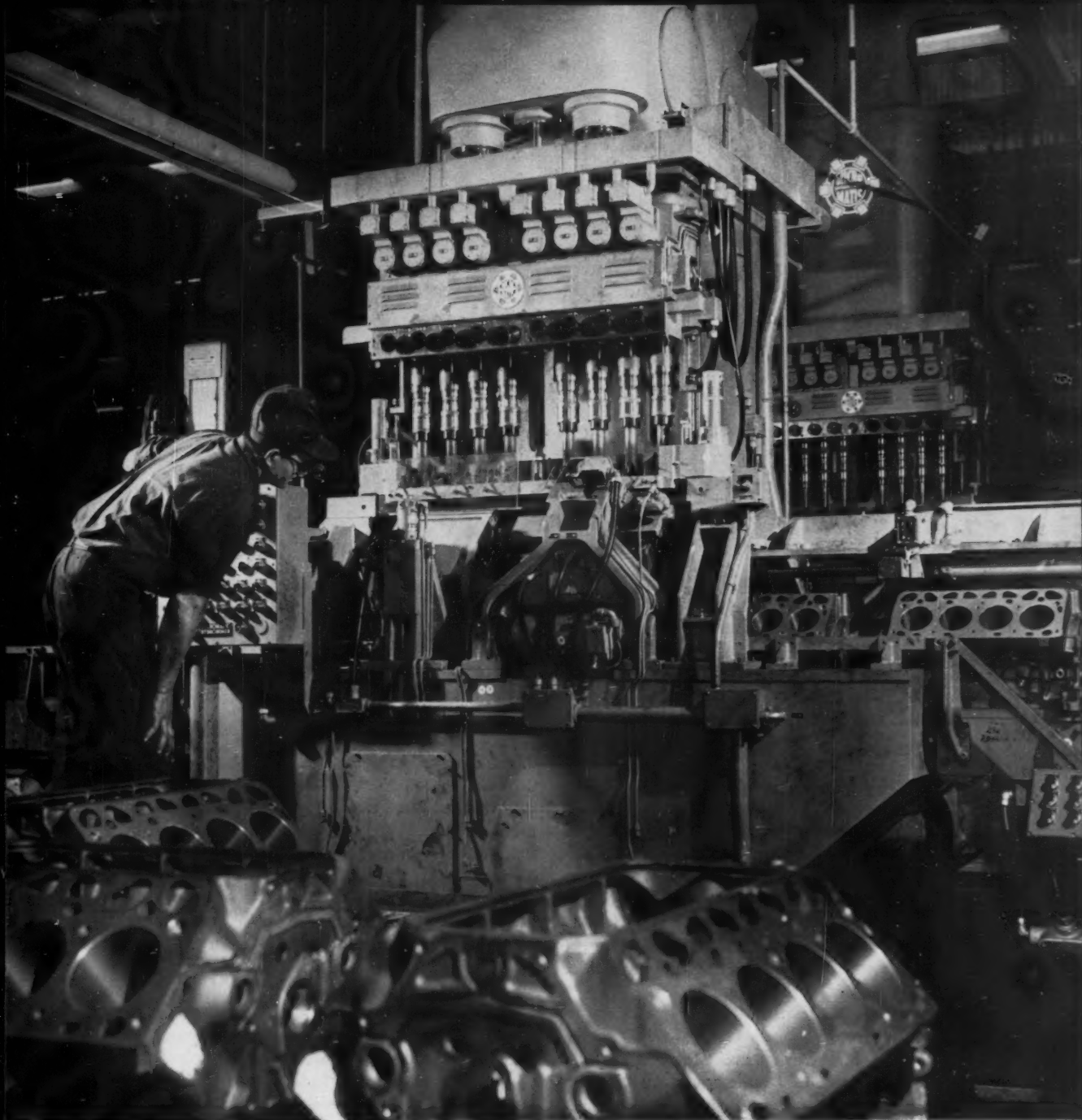
RYERSON STEEL

PRINCIPAL PRODUCTS: Carbon, alloy and stainless steel—bars, structurals, plates, sheets, tubing, industrial plastics, machinery & tools, etc.

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Photo, Courtesy of Ford Motor Co.

AUTOMOTIVE PRODUCTION NUMBER

1956

Vol. 63 No. 3

MACHINERY

November, 1956

PONTIAC CRANKSHAFTS ARE SHELL-MOLDED CASTINGS

By R. C. ROBINSON, Superintendent

Work Standards and Methods Engineering
Central Foundry Division
General Motors Corporation
Danville, Ill.

PONTIAC'S new crankshaft, shell-molded of pearlitic malleable iron, should be high on any list of significant innovations in the automobile industry. As a replacement for the traditional carbon-steel forging, a number of advantages are claimed. For example, it is produced quickly and economically on a highly mechanized foundry line, and does not require strategic materials that in past periods have been in short supply. Because the crankshaft is cast in a shell mold, it enters the machine shop close to finish size, with only a small amount of metal to be removed. Physical properties compare favorably with the forged product, and chemical composition can be closely controlled. In service, the crankshaft displays excellent bearing qualities and damping characteristics.

The crankshafts are produced at the Danville, Ill., plant of General Motors' Central Foundry Division. This plant has two main foundry areas—gray iron and malleable iron—and makes a variety of castings. Crankshafts undergo special annealing and drawing operations, following founding. GM terms the metal whose microstructure is acquired by this heat-treatment ARMASTEEL (ARrested MAlleable iron with STEEL-like characteristics).

Crankshafts are poured "two-on," as can be seen in Fig. 1. The mold receives 284 pounds of metal: 128 pounds for the two crankshafts; and 156 pounds for the sprue post, runners, and four bobs (risers). Later, turning and grinding at Pontiac remove 10 pounds of metal, giving the finished crankshaft a weight of 54 pounds.

Molding the shell is the first step in crankshaft processing. The shell material consists of 75 parts

Vassar sand (AFS 103 to 109), 25 parts bank sand (AFS 63 to 74), and 6 parts powdered resin. After thorough mixing in a muller, it is conveyed through tubes to bins above two Sutter shell-making machines. One of the machines molds the cope, and the other, the drag. In Fig. 2 is a view of the drag machine. The cope machine is located next to it.

From the bins, the material flows to an investment box beneath each machine. The pattern is made of cast iron and maintained by electric rod heaters at 450 degrees F. After a solution of wax and water is sprayed on the pattern, the machine goes through an automatic cycle in which the shell mix is first invested on the pattern.

Then, pattern and invested material are enveloped by a gas-fired oven for curing at 1000 to 1200 degrees F. Curing period is approximately forty-one seconds for the cope and fifty-nine seconds for the drag. With curing completed, the oven retracts and the shell is stripped from the pattern. (In Fig. 2, the operator has just stripped the drag shell.) Each machine can turn out twenty shells per hour.

Cope and drag shells are bonded together in the machine shown in the heading illustration and also in Fig. 3. The cope is positioned in a fixture, and a glue template laid on top (Fig. 3). Powdered glue is applied by a fixture which pivots into place over the template. Next, the template and glue fixture are removed and the drag half is positioned over the cope (heading illustration). Both halves are then advanced into the machine and squeezed together until the glue sets up.

The completed shell mold weighs about 88



pounds and measures 24 by 36 inches. After gluing, it is placed on a set-off table and pushed pneumatically onto a conveyor for delivery to the pouring line in the foundry. The conveyor has its own storage system, so that shell-making can proceed during lunch periods or other delays in the foundry. In Fig. 4, a shell is shown in transfer to an intermediate conveyor leading to a shell setter.

Each shell is conveyed in a cart which forms a flask for bedding sand. Movement of the flask actuates a locator on the setter which lowers the shell into the prepared sand bed. There, the shell is released and vibrated into the sand to prevent it from burning. The mold conveyor now moves under a cope bedder, Fig. 5, where a layer of sand is deposited on top of the shell and packed around the sprue post, runners, and bobs by small plows.

After bedding, the shells move on to the pouring area, Fig. 6. Temperature of the molten iron is 2650 degrees F. Its chemical composition (in percentages) is 2.55 carbon, 1.40 silicon, 0.45 manganese, 0.12 sulphur, and 0.05 phosphorus. The metal solidifies and starts to cool as the mold

leaves the pouring area and travels to a debobbing station.

The 12 1/2 square inches of metal joining the bobs to the crankshaft is broken by the impact of two large pendulums. Then, a pair of air-actuated arms removes the bobs and sprues from the crankshaft, which, with the shell and bedding sand, is pushed onto an oscillating conveyor from the mold cart. Upon entering the conveyor, illustrated in Fig. 7, guides position the crankshafts flange end forward to facilitate later automatic handling. During the trip up the oscillating conveyor, the sand and crumbled shell are shaken out.

At the end of the oscillating conveyor, hooks engage the flange ends, picking up the crankshafts two at a time and carrying them outside the building in a fifty-four-minute cooling cycle. Passing over a roller, the crankshafts are next released from the hooks and fall into troughs. There, they are positioned upright and enter a conveyor traveling through a shot-blasting cabinet. Upon emerging, the crankshafts are individually inspected.

A transfer mechanism, called a walking beam, provides a paced flow of the crankshafts to the

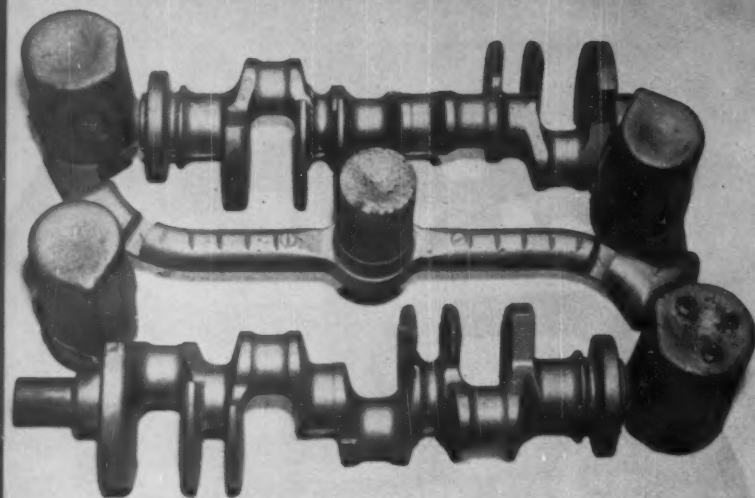


Fig. 1. Crankshafts are molded and poured "two-on." Actually, there is more metal in the runners, sprue post, and bobs than in the two crankshafts.



Fig. 2. The operator has stripped and removed the cured drag half of the shell from the machine. Another machine molds the cope half.

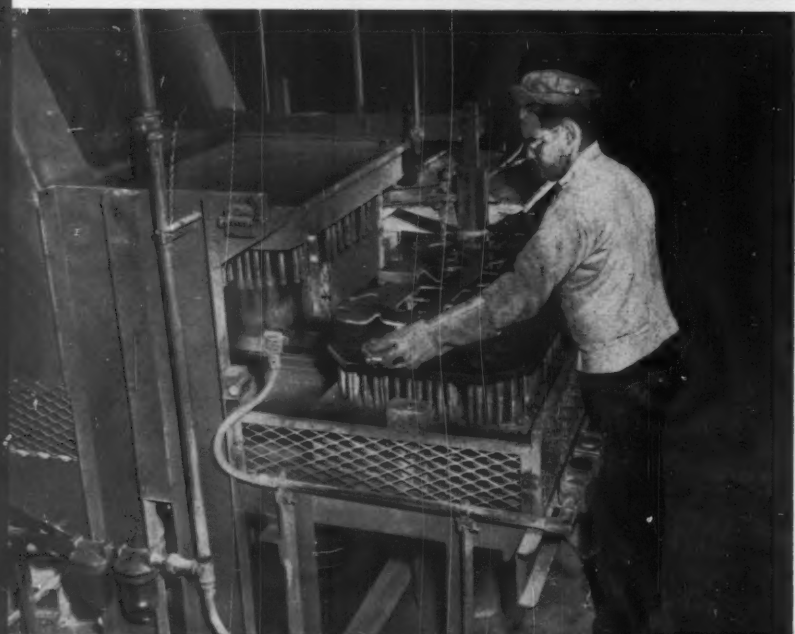


Fig. 3. The glue template is positioned over the cope half of the shell, preparatory to applying the powdered glue.

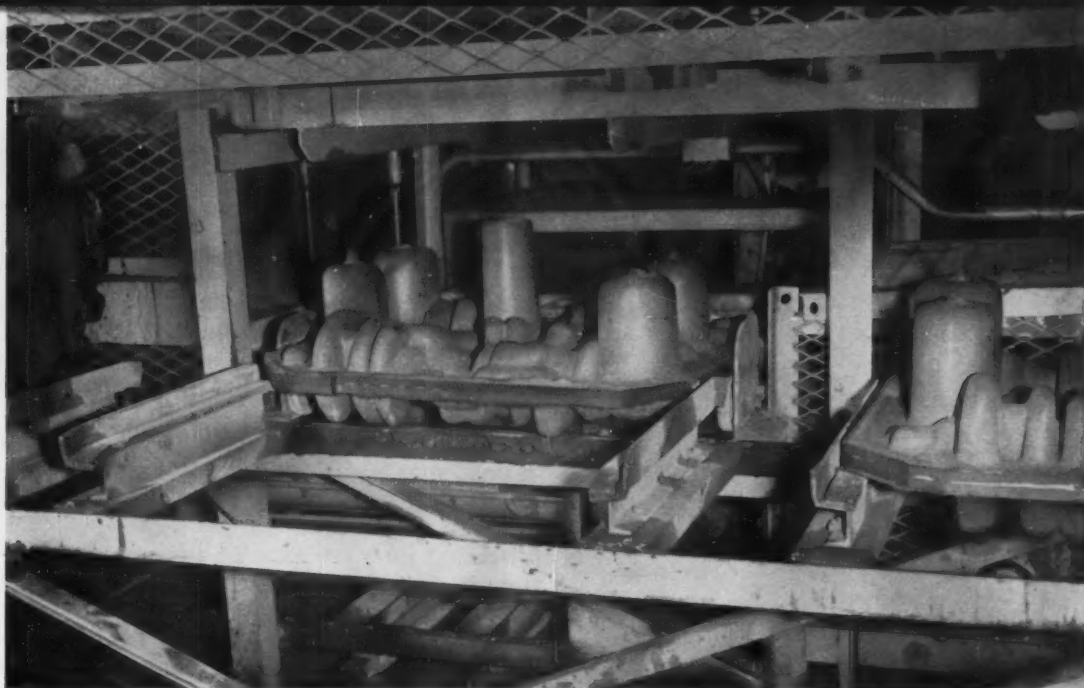


Fig. 4. Shells are transferred to this intermediate conveyor on their way to the setter. An integral storage system keeps shell-molding schedules independent of the rest of the foundry.

stand grinders seen in Fig. 8. Fins are ground off free-hand. The operator uses an overhead cradle to bring the work from the walking beam to the grinder and to support it while removing the fin. In the foreground are finished crankshafts stacked on trays for heat-treating.

Full trays are pushed onto powered rails, then loaded on an automatic dispatch carrier feeding two Swindell-Dressler annealing furnaces. In Fig. 9, trays are shown being lifted into one of the furnaces. This is a continuous operation, with thirty crankshafts handled in each push.

The trip through the annealing furnace takes twenty hours and thirty-six minutes. Atmosphere is carefully controlled, and the temperature for the major part of the soaking period is held at 1750 degrees F. Near the end of the furnace, the temperature is reduced to 1680 degrees F. Upon leaving the furnace, the crankshafts are cooled rapidly beneath large air ducts. At this point, Brinell hardness is 302 to 321.

The desired Brinell hardness of 217 to 269 in the finished product is obtained by drawing at 1290 degrees F. for eight hours and twelve min-

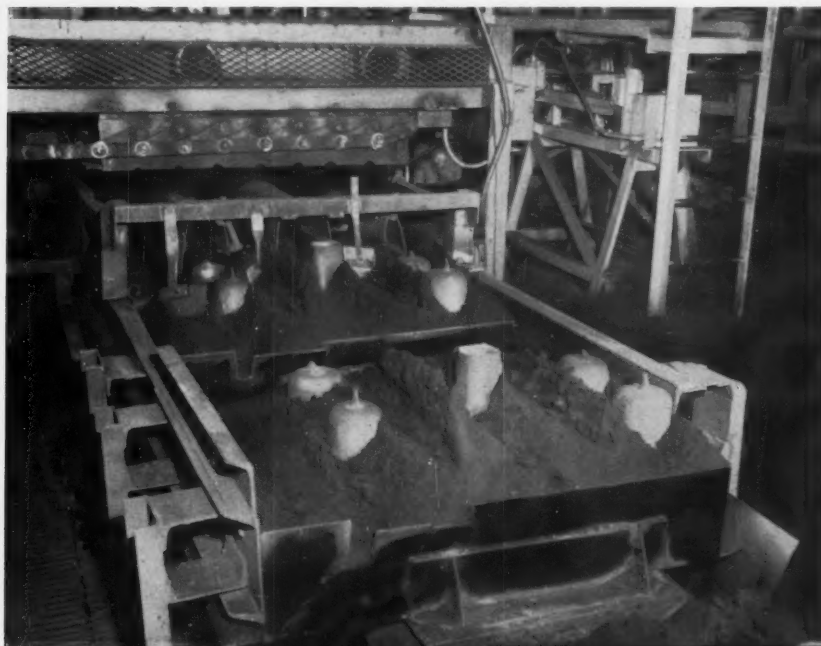


Fig. 5. The cope bedder deposits sand on top of the shell. Small plovers push the sand around sprue posts and bobs as shell moves forward.

Fig. 6. The shell mold is filled with 284 pounds of iron. After the metal has solidified, heat-treating will remove all massive carbides from the white iron.

utes. Physical properties obtained are: minimum tensile strength, 90,000 pounds per square inch; minimum yield strength, 60,000 pounds per square inch; and elongation, 3 per cent in 2 inches.

Distortions from heat-treating are removed in a press straightening operation. Since the crankshafts must be worked while still hot, they are directed to a small holding furnace upon their discharge from the drawing furnace. Temperature in the holding furnace is 1220 to 1240 degrees F.

In Fig. 10, the workman on the right is transferring a batch of five crankshafts to the press loading rails from the holding furnace. The press,

Fig. 7. (Right) While the crankshafts move up on oscillating conveyor, the burnt shell and sand are shaken out and removed.

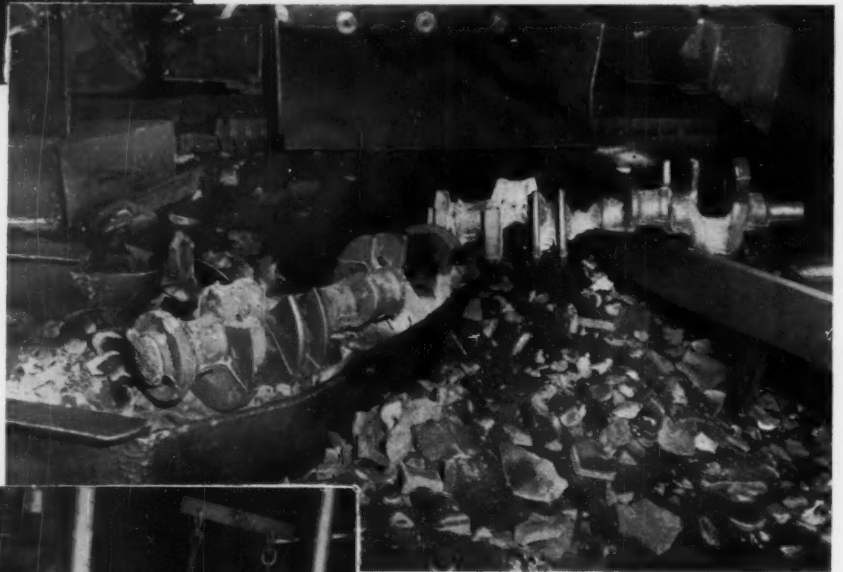
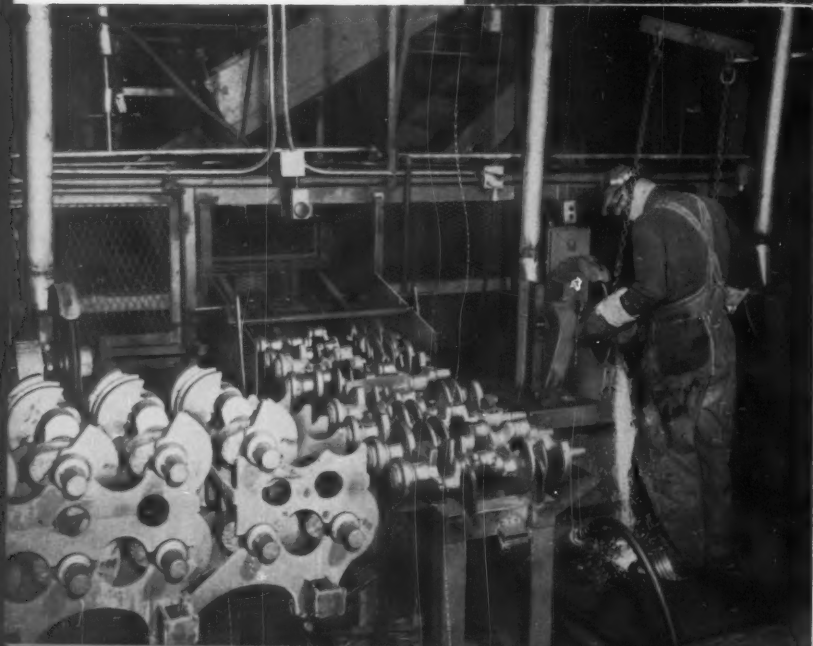


Fig. 8. (Left) Crankshafts are taken off the walking beam and brought to stand grinders, where the fins are removed.



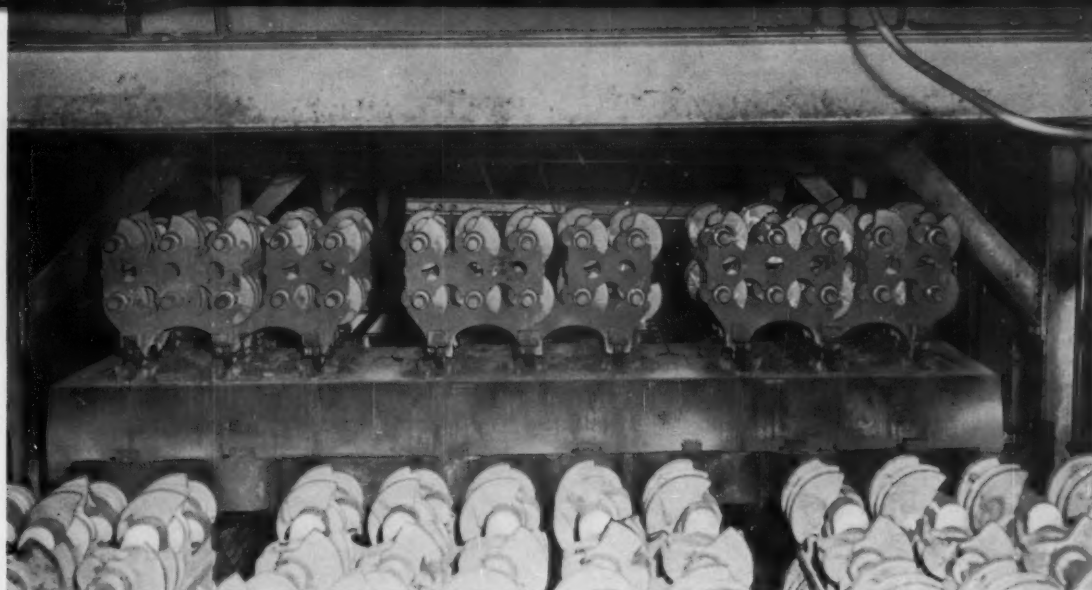


Fig. 9. Thirty crankshafts per push, grouped in trays, are elevated into the annealing furnace for the almost twenty-one-hour trip.

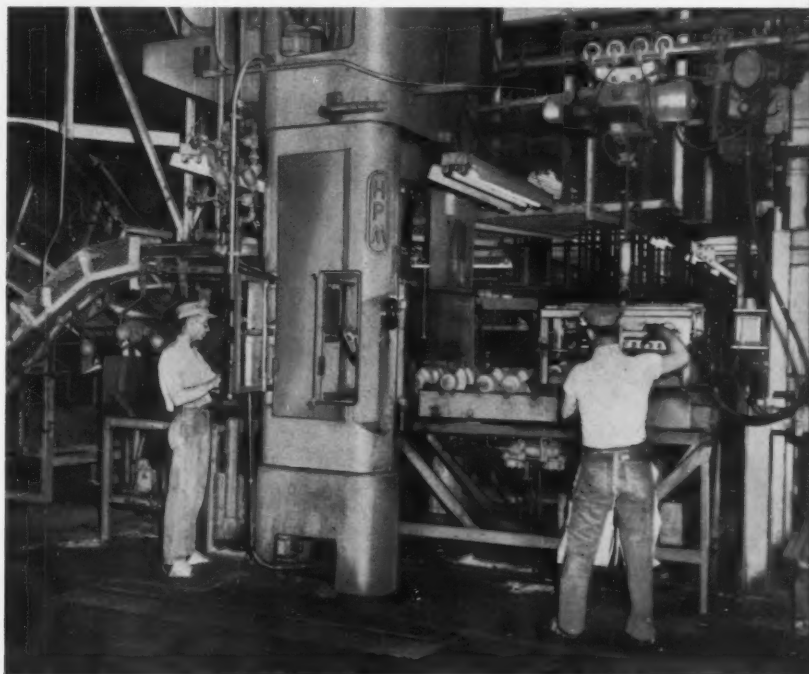
a 500-ton H-P-M, is equipped with straightening dies. Each crank is pressed once, revolved 90 degrees on its axis, and pressed a second time. It is then ejected automatically, rolls down to a conveyor pick-up, and is carried outside of the building to cool.

When the crankshafts re-enter the building, they go into a Gogan hardness tester, Fig. 11. As the work advances through the machine, it indexes at two stations. At the first station, a spot is ground on the crankshaft. When the work indexes

to the second station, a head descends and performs a Brinell test of the ground spot. The head interprets the reading and actuates one of two dye spray guns at the second station. Crankshafts within the proper hardness range are color-sprayed; those that are too hard are not sprayed; and those that are too soft are sprayed with a different color. The entire test is automatic.

Two machining operations are performed in the Danville foundry. The first, shown in Fig. 12, consists of removing the large gate on the pin

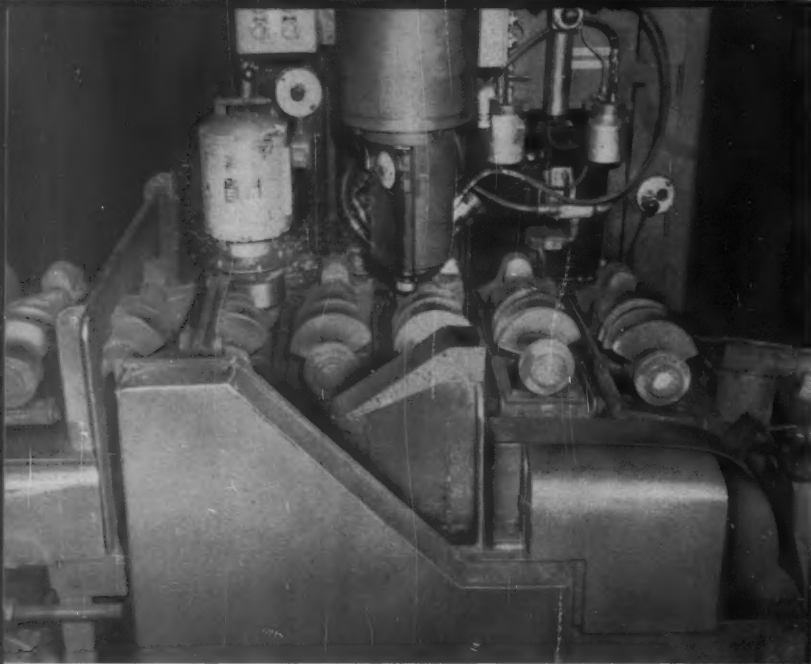
Fig. 10. From the holding furnace, the crankshafts are straightened in a two-stage, closed-die, hot-pressing operation.



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Fig. 11. (Left) Cooled crankshafts pass through this automatic Brinell hardness testing machine.

Fig. 12. (Below) Milling the gate off the pin end of the crankshaft. This is one of the two machining operations performed in the foundry.



end of the crankshaft. A hydraulically operated fixture supports the work at an angle to the cutter. The machine is a Sundstrand Rigidmil. Average depth of cut is $3/8$ to $1/2$ inch.

Following shot-blasting, the crankshafts proceed to the second machining operation. Here, length is established by face-milling both ends. In the same setup, the ends are center-drilled for later processing at Pontiac. Cycling is automatic, and one operator runs two Sundstrand Centrmil machines. One of them appears in Fig. 13.

A hydraulic positioning mechanism locates the crankshaft centrally from the two end throws. On each side of the machine is a spindle-carrier containing a face mill and a center drill. After the work is loaded, the carriers move to the front, executing a traverse and feed for the milling.



Fig. 13. (Left) Two opposed spindle-carriers operate at each end of the crankshaft, first milling them to length, then center-drilling them.



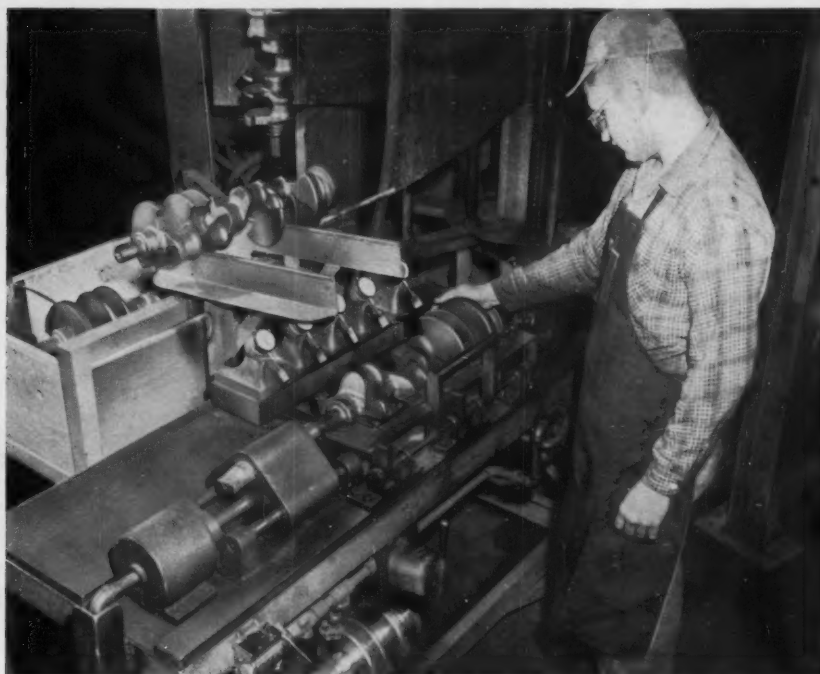


Fig. 14. The throws of the crankshaft are inspected for clearance and runout by means of a row of dial-indicator paddle gages.

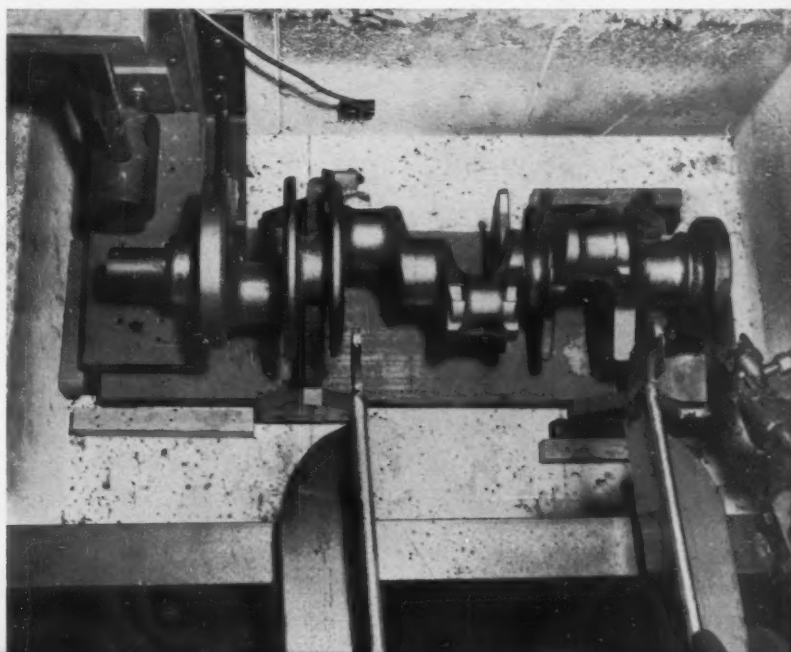
They then retract, and the two center drills traverse and feed toward the work. The combined operation assures that the centers are square to the ends and all have the same depth.

A check for throw clearance and runout is made with the inspection device seen in Fig. 14. The work is held between centers and rotated manually. A row of five paddle gages intercepts the paths of the throws, giving individual readings for each throw. The centers engaging the work are air-actuated and spring-loaded, to speed handling.

Next, in an ingenious testing "merry-go-round,"

the crankshafts are lowered through an electromagnetic coil and sprayed with a Magnaglo solution. Indexing brings them into the black light of an inspection booth, where cracks and surface imperfections appear as bright greenish-yellow lines of fluorescence. The final indexing brings the work to a sonic test chamber, Fig. 15, where a hammer delivers a sharp blow on the pin end. If frequency is within range, the opposite end is sprayed with a yellow dye, indicating a sound crankshaft. After the sonic test, the crankshafts undergo a final visual inspection, and any small fins or projections are ground off.

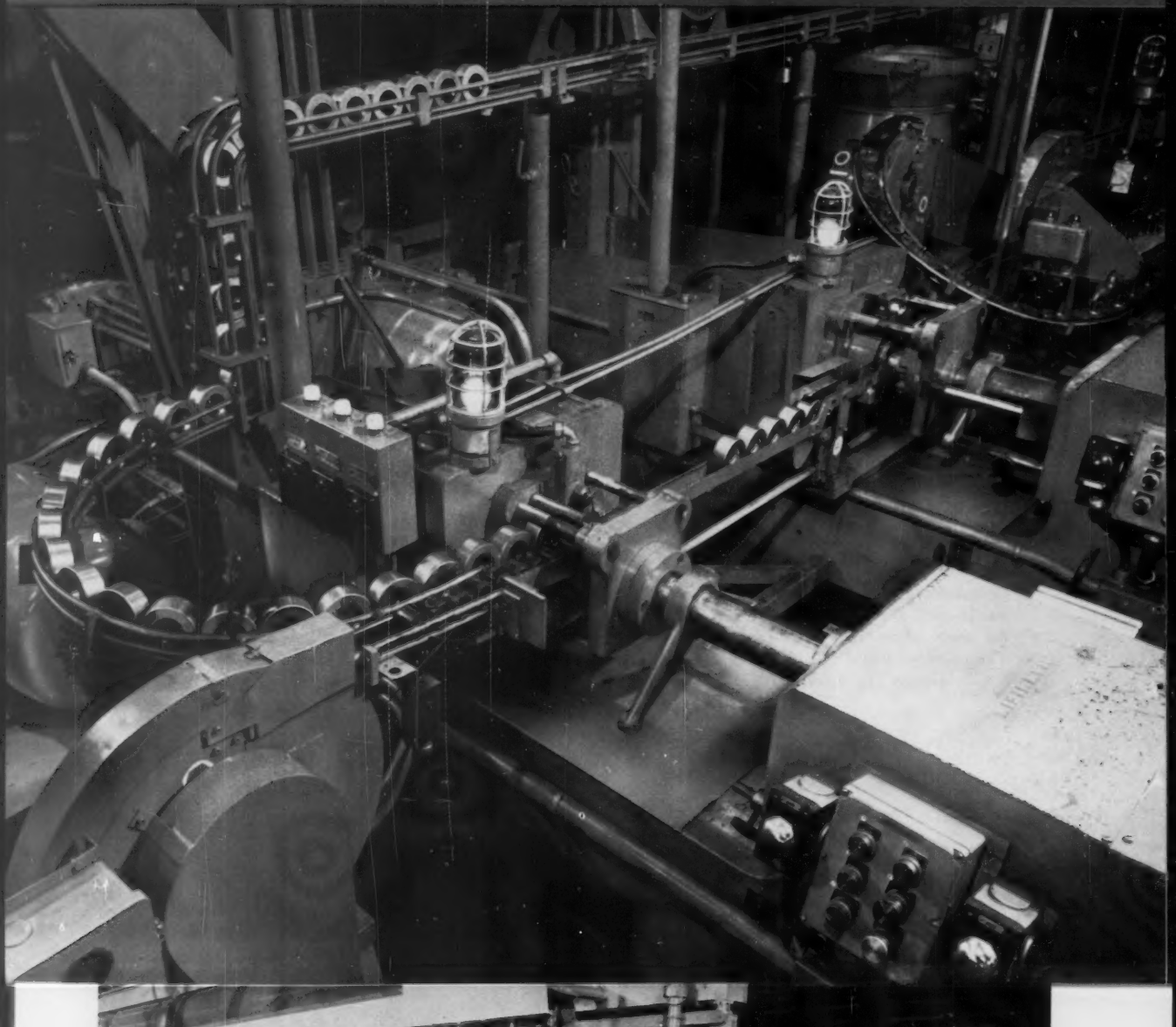
Fig. 15. Soundness of the crankshaft is checked in this sonic test. The hammer can be seen above the pin end. Frequency must be within range specified.



AUTOMATIC ASSEMBLY OF FORD AUTOMOTIVE PARTS

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Distributor contact brackets, generator commutators, distributor terminal housings, and horn mounting brackets are among the many automotive parts assembled on completely automatic and semi-automatic machines. Some of the rectangular, in-line, and rotary indexing units incorporate both machining and assembling stations.

ONE of the fields to which considerable attention is being given with beneficial results is in the automatic assembly of automotive parts. Components such as studs, brackets, washers, inserts, springs, and rivets are stored in and automatically fed from hoppers, magazines, or chutes. Parts are assembled and, in some cases, machined as they are carried in fixtures along rectangular, in-line, and rotary indexing machine bases.

Direct benefits of automatic, or even semi-automatic, assembly are higher production, improved quality, and lower cost. Outstanding examples of completely automatic as well as semi-automatic assembly machines employed at the Parts and Equipment Mfg. Division, Ford Motor Co., are illustrated and described.

Distributor terminal housings are assembled and the contacts faced automatically on the machine shown in Fig. 1. Housings are made from a phenolic thermosetting plastic that is cured in compression type molds with brass or aluminum inserts in place. The molded housings slide down the chute seen at the left (foreground). At the bottom of the chute, hydraulically operated mechanical fingers rotate each housing 180 degrees in a vertical plane and place it, open side up, in one of the sixty L-shaped work-carriers that are clamped to the continuous chain mounted in the base of the assembly machine. Intermittent indexing of the carriers transfers the housings from station to station, in a clockwise direction, along a rectangular path around the machine.

Such rectangular indexing, automatic assembly machines are called "Autocycle," a Ford-coined name. Autocycle was selected because the principal function is automatic cycling, with assembling, machining, and inspecting operations being performed automatically during the dwell time of the cycle. The Ford-built machines consist essentially of the necessary tooling and electrical controls added to purchased transfer machine bases.

Assembly machine bases are equipped with a complete power-transmission unit, a cam-operated indexing mechanism, a double roller chain for transferring the work-carriers, and a combination magnetic clutch brake. Standard units are available with from forty to seventy-two stations and carriers, and 3- to 12-inch index travel. Flexibility is provided by the sectional construction of

the base frames, which permits adding or removing standard sections.

In one unit, indexing is accomplished by pre-loaded ball bearing followers that roll along the tapered sides of a cam rib. Another cam-indexing unit, consisting of a plate-cam and roller followers, drives a sprocket incorporating a pin type clutch for convenient disengagement to facilitate alignment of operational devices and tooling. On all Autocycle machines, an intermittent-motion camshaft controls the operation of the tooling. Also, electrical controls are interlocked to synchronize the indexing cycles with the actuation of the tools. Attendants can stop the machines by depressing push-buttons located at various stations around the machine.

On the distributor terminal housing assembly machine, a hydraulic cylinder is provided below each working station to lift the housings from their carriers and clamp them while the operations are performed. At the second station on this machine, the housing is rotated to orient it with relation to a keyway molded in the part. A vent-hole, 1/8 inch in diameter, is drilled through the side of the housing when it has been indexed to the third station. Boring heads are mounted vertically above the work-carriers at the next three stations for rough- and finish-boring the brass or aluminum inserts, as well as reaming and spot-facing the center terminal.

A close-up view of the rough-boring station (taken from below the level of the work-carriers) is seen in Fig. 2. The hydraulic cylinder for lifting the work-piece is visible at the bottom, and the milling cutter, at the top. The cutter has five insert type, tungsten-carbide tipped blades. Flexible hoses from a dust and chip collector are mounted directly above the path of the work-carriers.

When the distributor terminal housing has been indexed to the opposite side of the assembly machine, Fig. 3, a carbon brush is automatically pressed into the reamed hole in the center terminal by means of an overhead hydraulic cylinder, seen at the upper right. The brushes are stored in a vibratory hopper that is mounted on a base and automatically fed down a track to the required position below the cylinder ram. At the next station, a probe ascertains that the brush has been inserted. If the brush is not pres-

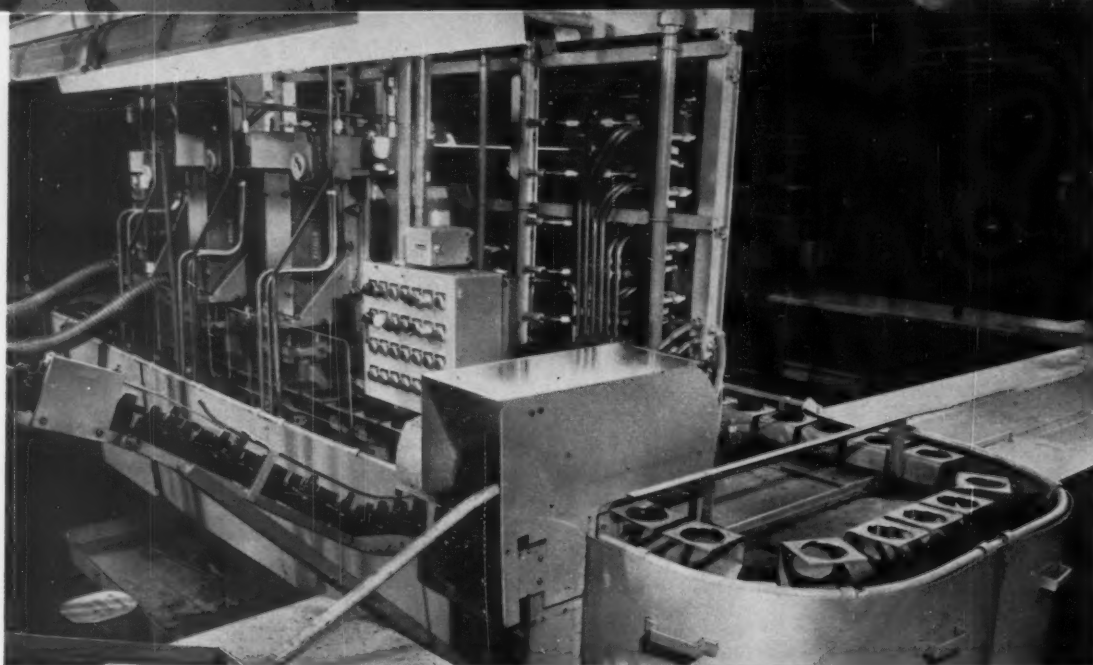


Fig. 1. Autocycle machine for distributor terminal housings. Molded plastic housings are machined, and carbon brushes are assembled.

ent, the housing is automatically rejected into a pan at the next station; and, if three successive parts are rejected, the machine is stopped.

At the next working station, a three-pronged tool is employed to stake the brush in position. Then, the distributor terminal housing assemblies are automatically ejected onto a conveyor belt leading to the final inspection and packing area. Empty work-carriers, seen at the right in Fig. 1, are indexed back to the loading station to receive new housings. The Autocycle can accommodate three different types of housings.

Distributor contact bracket assemblies—each consisting of a brass washer, a steel bracket, a brass stud, a fiber insulator, and a brass post—are fitted together on a semi-automatic machine, illustrated in Figs. 4 and 5. The machine consists of the required tooling and supply hoppers arranged around the periphery of a twelve-station, rotary indexing table, 18 1/4 inches in diameter. Heights from the top of the machine base to the locating surfaces on the twelve fixtures are maintained within 0.0005 inch.

Brass studs for the distributor contact bracket assemblies are stored in the vibratory hopper seen at the lower left in Fig. 5, and are automatically positioned and fed down a track to the first station. Here, a hydraulic cylinder loads a stud into each empty fixture. When the fixture has been transferred clockwise to the second station, another hydraulic cylinder is employed to index the square head of the stud into the required position. A die, seen at the upper left, is provided at the third station to pierce and cut off a fiber insulator from coil stock, and place the insulator on

the stud. The fiber material, in coil form, is supplied from a reel located behind the die.

Stations 4 and 6 are idle, but the operator manually places a stamped sheet metal bracket on each fixture as it is indexed to the fifth station, Fig. 4. Another die, located at the seventh station, stamps a brass washer from coil stock (supplied from the reel seen at the left), loads the washer on the stud, and folds the fiber insulator. The washer is staked in place by means of hydraulically actuated tooling at the eighth station, and the steel bracket is correctly positioned with relation to the post and fixture at Station 9. A brass post, supplied from the vibratory hopper shown at the right in Fig. 5, is pressed into the bracket and staked in place at the tenth station. A letter "F" is stamped on each bracket, and the assemblies are automatically ejected into tote pans at the next two stations. Empty fixtures are returned to the first station, and the cycle is repeated.

Another Autocycle machine, Fig. 6, is employed to assemble horn mounting brackets. Because six brackets of different shape are required for various model automobiles, the assembly machine was made semi-automatic to handle all parts on one machine. While sixty workholding fixtures are intermittently indexed around a rectangular path on the continuous roller chain, only one side of the machine has been tooled. This provides ample capacity to meet production requirements.

Horn mounting bracket assemblies each contain a formed steel bracket, a reinforcing plate, four flat steel springs (two upper and two lower), two cast zinc spring spacers, and two solid cham-

fered rivets. Only the brackets are manually loaded on the fixtures. The reinforcing plates, spacers, and rivets are automatically supplied to the required feeding positions by the motorized hopper units seen from left to right, respectively. The two spacer supply tracks are visible on the center hopper. Springs are prestacked on rods and suspended from rotary hangers above the stations at which they are automatically positioned on the fixtures. The carrier seen directly behind the first hopper supplies the two lower springs for each assembly, while the one behind the center hopper feeds the two upper springs into position.

Hydraulically actuated shot pins enter the fixtures to insure accurate location when assembling the reinforcing plates, springs, and rivets. Also, probing stations are provided after each assembly operation to insure that the parts have been properly positioned. If any part has not been assembled, or is incorrectly aligned, a light flashes, and the machine stops. A hinged Lucite safety gate is provided above the work-carriers, next to the op-

crators position, so that an improperly mounted, manually loaded bracket will stop the machine. The close-up view of the riveting station, Fig. 7, clearly shows the rivet supply tracks at the top, and the horn mounting bracket assembly at the bottom. Completed assemblies are automatically ejected onto a discharge chute at the next station. Here, another safety device is provided to stop the machine if an assembly does not fall onto the chute after each index cycle.

An example of a straight, in-line type of assembly setup, consisting of various machines connected by automatic material-handling devices, is illustrated in Fig. 8. This installation is used to assemble generator commutators. A typical commutator, Fig. 9, contains twenty-eight copper segments and twenty-eight bonded mica insulators, alternately spaced around the periphery of a steel sleeve and secured in place by two steel clamp rings. Contact between the clamp rings and the copper segments is prevented by two more mica insulators.

The generator commutator segments and in-

Fig. 2. Close-up view of the rough-boring station on the machine seen in Fig. 1. A hydraulic cylinder (bottom) lifts part into contact with milling cutter.

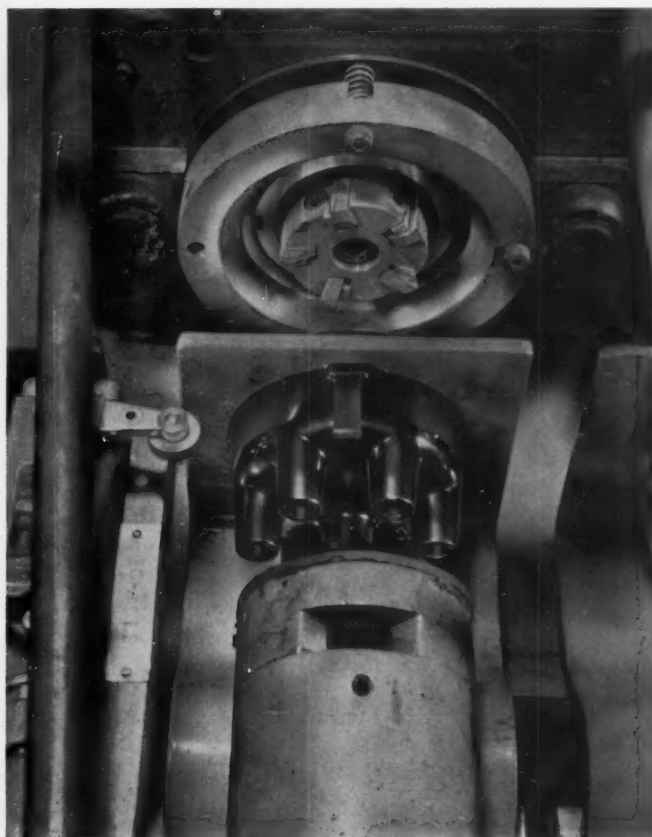


Fig. 3. Carbon brushes stored in vibratory hopper are fed down a track and pressed into housings. A probe detects the presence of brushes in the housings.

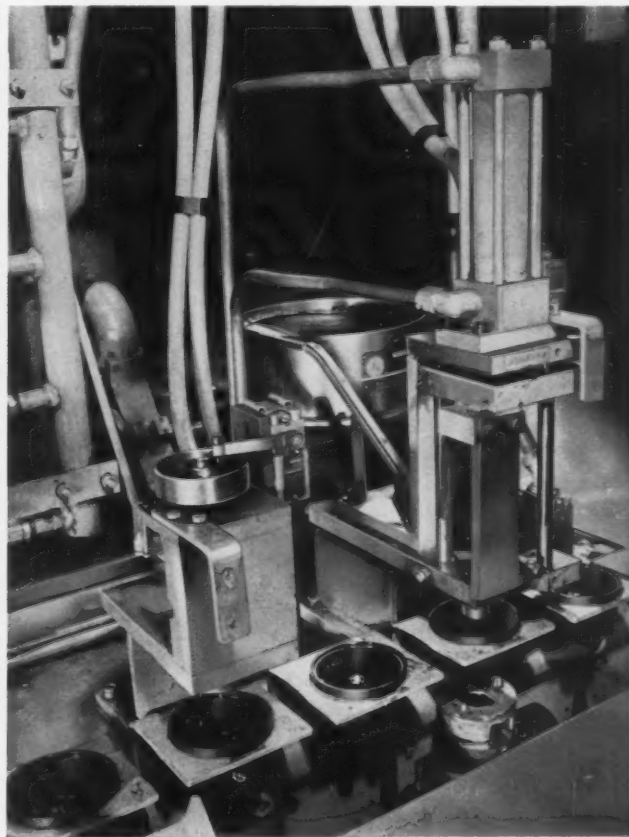
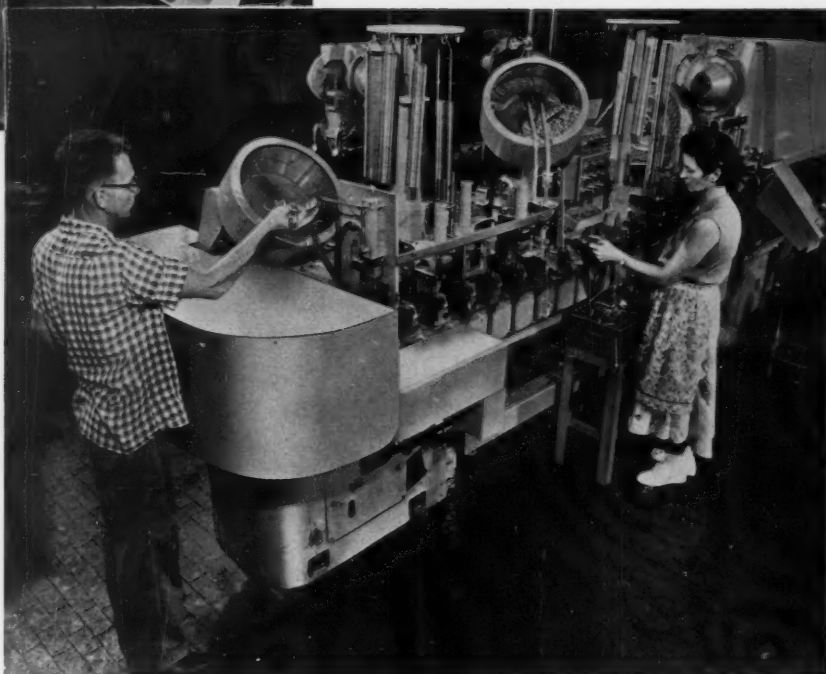


Fig. 4. (Right) Manual loading station of a semi-automatic machine for assembling distributor contact brackets. Coil stock seen at the left is stamped into washers on the machine.



Fig. 5. (Left) Rear view of machine illustrated in Fig. 4 shows hopper for feeding brass studs at lower left, and hopper for supplying brass posts at the right.

Fig. 6. (Right) Horn mounting brackets are assembled on this Autocycle machine. Machine was made semi-automatic to accommodate different shaped brackets.



ulators are assembled into temporary split ring holders on automatic "wrap-up" machines, three of which can be seen at the left in Fig. 8. Insulators are prestacked in forked magazines that are placed, one at a time, in a holder on each machine. In the close-up view of one wrap-up machine, Fig. 10, this holder is seen at A. The cold-formed segments are dumped into a selector type hopper on top of each machine from an overhead belt conveyor and automatically feed down track B. First a segment and then an insulator are alternately fed from the track and magazine respectively until a column containing twenty-eight of each has been automatically formed along ways on the machine.

A hydraulic cylinder is used to pull the column of segments and insulators into a circular shape in fixture C. Then, two hydraulic rams (one pushing and one pulling) grasp the fifty-six components by their dovetail surfaces and transfer them into a temporary split ring holder. These holders are fed into the machine, one at a time, from an overhead chute D. The pusher hydraulic ram can be seen at E. Loaded holders are automatically ejected into chute F, from which they roll into an inclined trough extending along the side of the wrap-up machines (Fig. 8). While the machines are completely automatic, attendants keep the machines supplied with parts.

Loaded holders from the wrap-up machines are elevated by means of a notched rotary disc, and roll into a die mounted on a 10-ton hydraulic press that is installed on its back, as seen in the

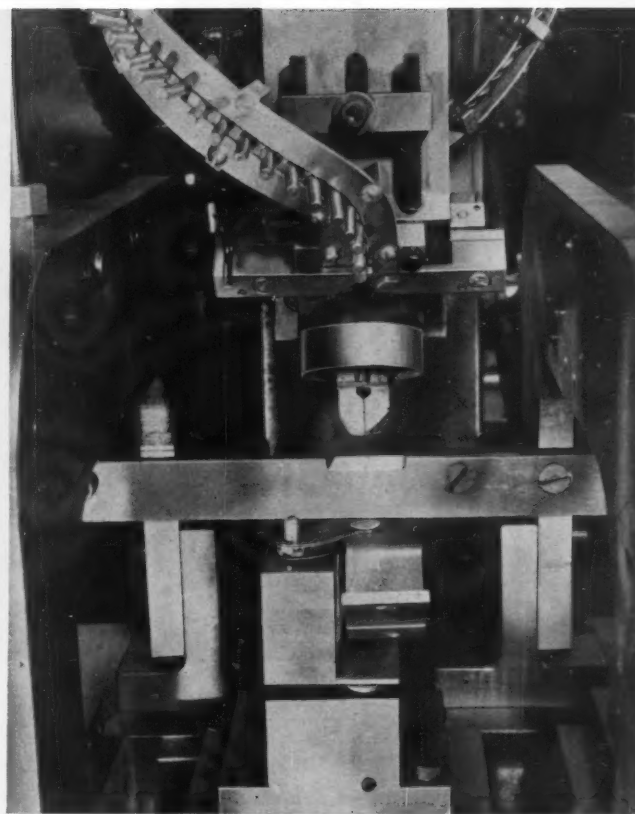
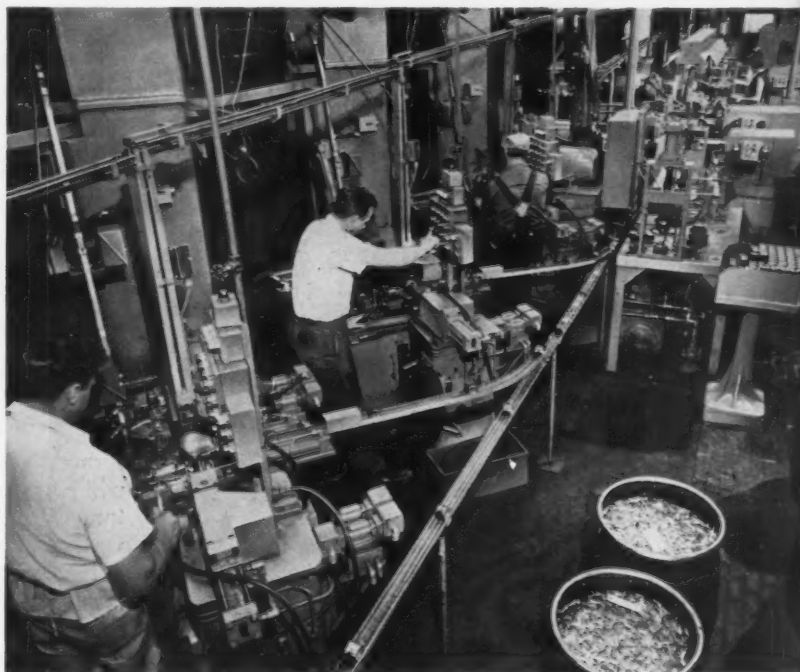


Fig. 7. Riveting station on horn mounting bracket assembly machine (Fig. 6). Completed assembly is seen mounted on work-holding fixture at bottom.

Fig. 8. Over-all view of the in-line setup for assembling generator commutators. Three automatic "wrap-up" machines are seen at left.



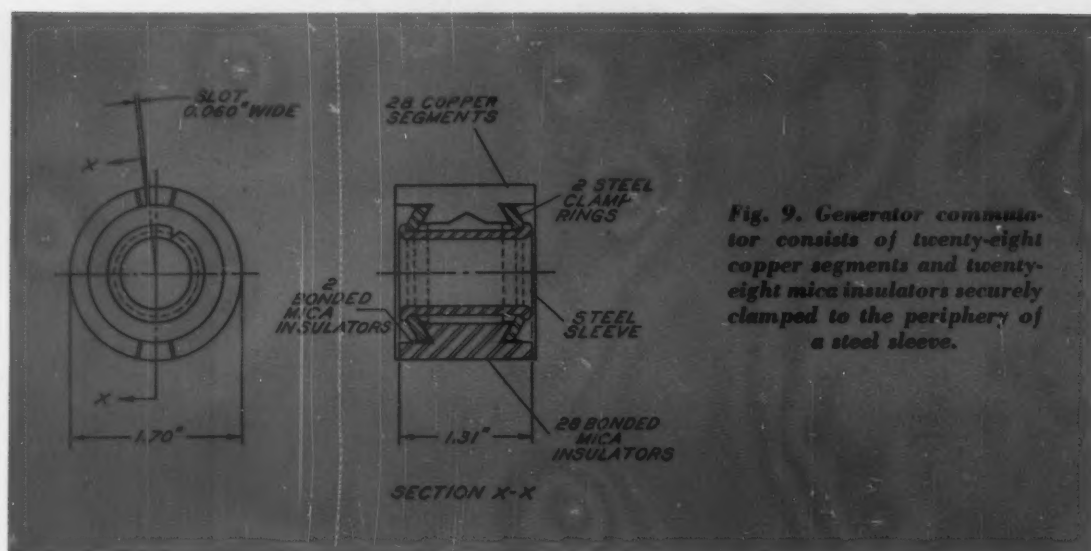


Fig. 10. Close-up view of automatic "wrap-up" machine for generator commutators. Insulators are fed from magazine in holder (A), and segments, from track (B).



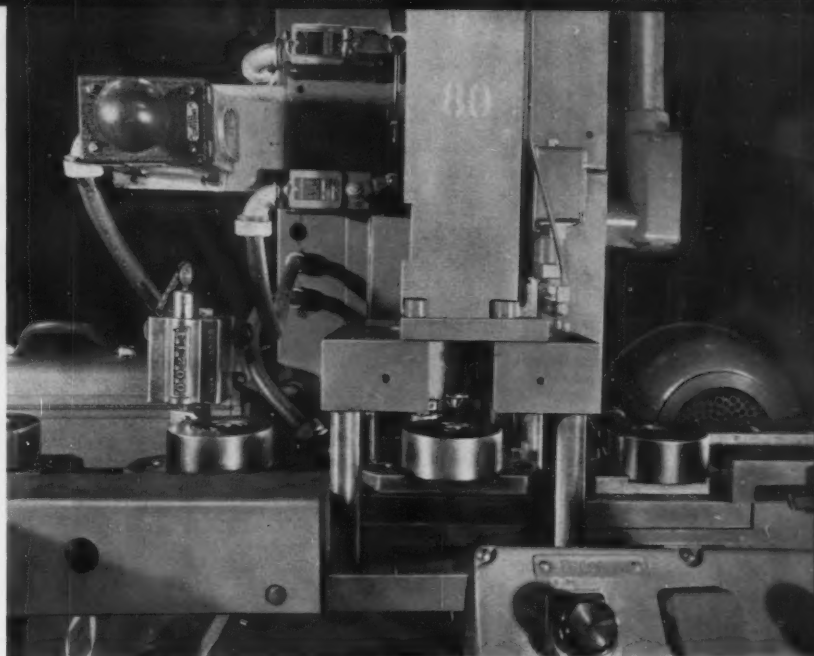
heading illustration. Simultaneously, empty solid ring fixtures from an overhead return track roll into the die. When a fixture and loaded holder are in the required side-by-side positions in the die, the press circuit is automatically energized. The punch presses the split ring (with segments and insulators) into the fixture. As the press ram returns, the loaded fixture is automatically ejected and rolls down a chute to the next operation.

A 15-ton hydraulic press, also installed on its back and seen at the right in the heading illustration, is tooled to coin the dovetail surfaces on both ends of the segment and insulator assembly. The assemblies are again elevated by a disc and rolled over into a horizontal plane by means of a chute. From the chute, the assemblies slide over sub-assemblies mounted on build-up fixtures called "boats," which are automatically transferred to subsequent operations. A clamp ring, mica insulator, and steel sleeve sub-assembly have previously been manually placed on the pilot of each boat.

The other clamp ring and mica insulator are nested together and placed on the top of the assembly. When the boat has been automatically indexed to the next station, Fig. 11, a tapered punch on the ram of a hydraulic cylinder flares the sleeve to hold the components together. To the right of this station is an opening in the track through which the boat drops. The boat is returned to its starting position by a belt conveyor, while the solid ring fixture containing the generator commutator assembly is tipped over into a vertical plane and rolls to the next operation.

Here, tooling in another 15-ton hydraulic press is employed to finish-flare the sleeve. Assemblies are automatically ejected and roll into the die of a 10-ton hydraulic press two at a time (one above

Fig. 11. Sleeve in center of generator commutator assembly is flared at this station. Components are held in split ring holder and solid ring fixture.

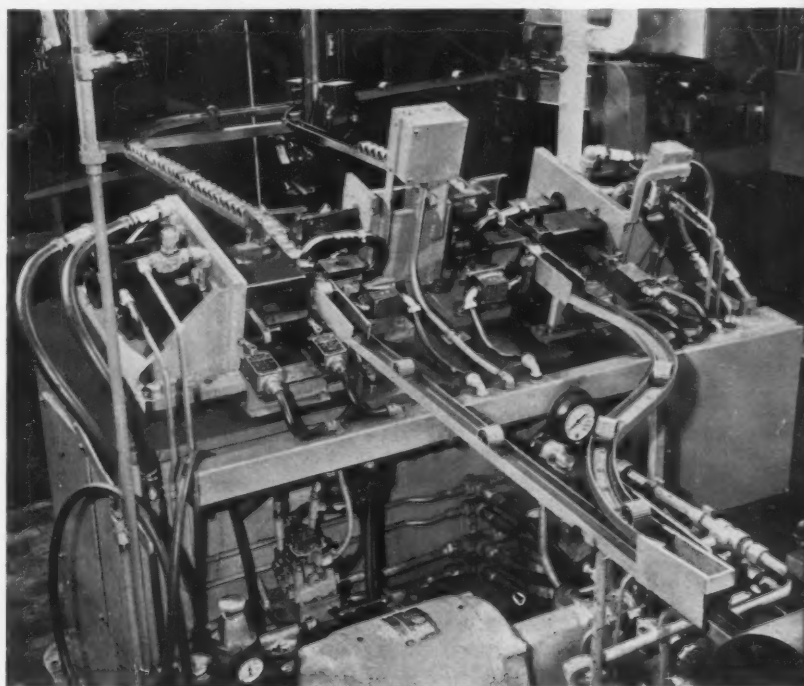


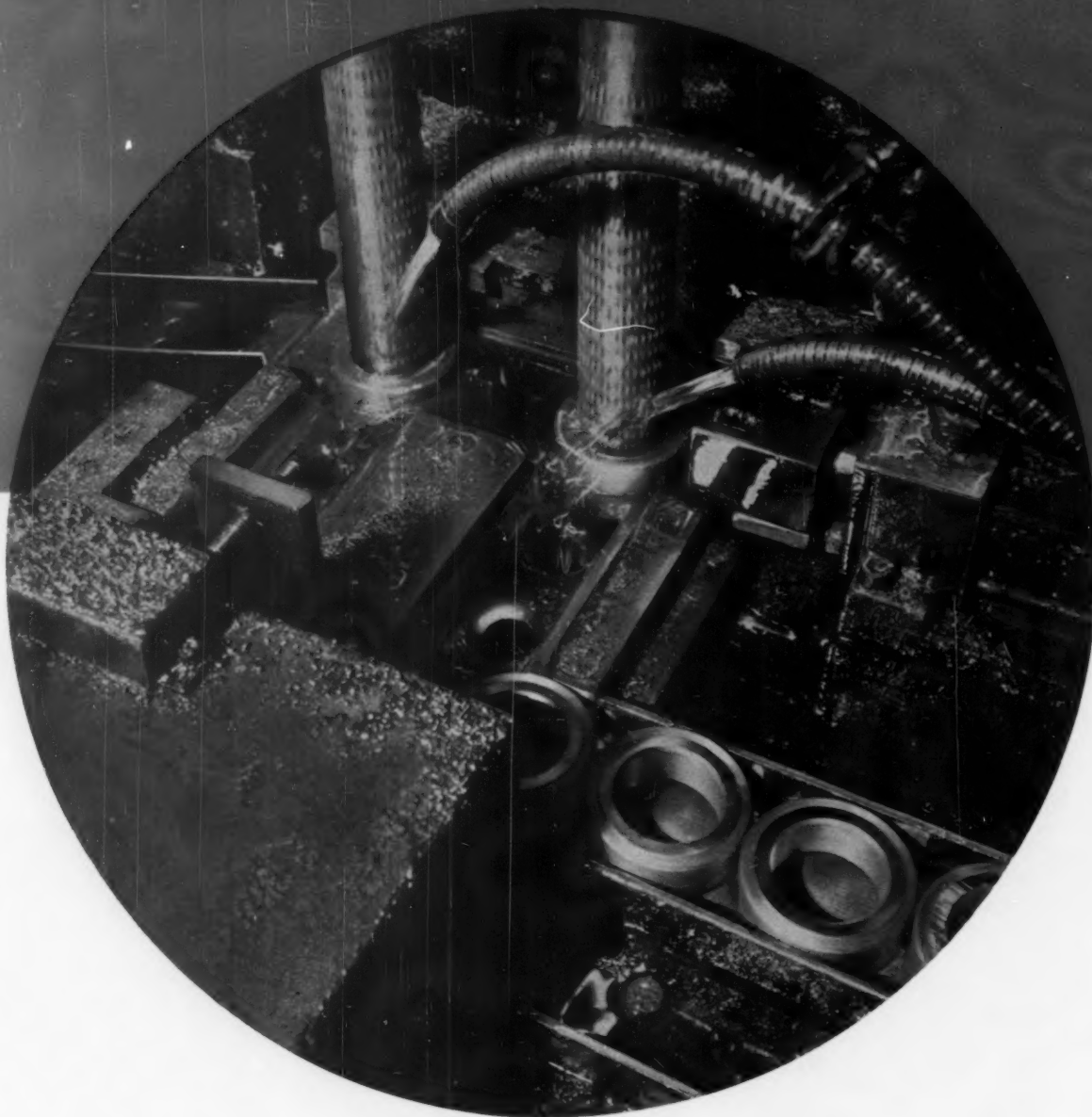
the other). The punches on this press automatically push the commutator assemblies from the split ring holders, as well as the holders from the solid ring fixtures. Holders and fixtures are automatically returned to their starting positions, while the assemblies slide down a chute into a 48-K.W., electric curing oven. An automatic loading mechanism deposits the parts on rods and in rows. The mica is subjected to a temperature of 400 degrees F. for seven minutes while curing.

Commutator assemblies are discharged from the oven into a chute, where they are divided to

alternately roll into opposite sides of a welder, Fig. 12. In this machine, the assemblies are heated by resistance to the passage of electrical current through the sleeves, while hydraulic pressure is applied to both clamp rings to tighten the assemblies. An annular groove in the center of the sleeve bore increases the resistance to the flow of current. At a second station on the welder, a steel sizing ball is pushed through each sleeve. Then, the assemblies are checked for shorts and grounds before the lead slots are milled with carbide saws on an index type milling machine.

Fig. 12. Resistance-welding machine is employed to heat commutator while hydraulic pressure is applied to tighten assembly. Ball-sizing of sleeve bore is also performed.





HYDRA-MATIC transmissions consist essentially of a fluid coupling and three planetary gear sets for automatically changing the torque-speed ratio between the engine and the rear axle to provide four forward speeds and reverse. Most models of the Hydra-Matic transmission contain an assortment of twenty-three precision gears—including internal, sun, pinion, pump, speedometer drive, and ring gears.

To transmit the high torque loads of today's powerful, high-compression engines, increased demands are placed on the precision gears used in the automatic transmission. Essential require-

ments are: transmission of torque at a low noise level, small size, long life with a minimum of service, and low cost. In general, the gear-tooth form is modified from the theoretical to obtain smooth, quiet operation at the high speeds and under the tremendous pressures to which the gears are subjected. The gears are usually of fine pitch and helical angle, with modified pressure angles and leads.

Long gear life depends primarily on proper material selection and heat-treatment, as well as the accuracy with which they are machined. Steels used for making gears at Detroit Transmission are purchased to guaranteed hardenability limit

FROM BLANKS TO GEARS IN ONE CONTINUOUS LINE

Loading and unloading devices, transfer equipment, inspection units, and sorting mechanisms permit the economical production of precision gears on a mass-production basis

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specifications, rather than only to chemical specifications. Also, economical machining is an important factor in the steel specifications. For example, medium carbon, chromium alloy steels (such as SAE 5140-H) are specified to have a Brinell hardness range of 187 to 207, with a uniform microstructure having lamellar pearlite and blocky ferrite. While the specifications of a softer steel would permit use of higher speeds and feeds in cutting-off, turning, forming, and boring, the selected hardness is an economic compromise since shaping of the teeth on hobbing machines requires a harder material to produce the proper surface finish.

Increased production, lower costs, and improved qualities have been attained through completely automatic processing of many of the transmission gears. Blanks produced on multiple-spindle, automatic bar machines are automatically loaded into and unloaded from the various machines in the line, transferred between operations, and inspected—resulting in finished gears without the need for tedious manual handling. The problem of distributing work-pieces from operations performed rapidly on single machines to those done more slowly on batteries of machines has been solved by special part-storage and ele-

vating units. These units bank sufficient parts to balance the output of subsequent machines.

Automatic Processing of Front Sun Gear

One of the transmission gears that is processed completely automatically is the front sun gear. Specifications for this gear, which is made from SAE 5140-H steel, are given in Fig. 1. Sun-gear blanks are rough-turned, bored, and faced, as well as chamfered and cut off, on multiple-spindle, automatic bar machines. Loaded gondolas of blanks are trucked to the gear machining line, where they are dumped into a storage hopper, seen in the foreground of Fig. 2.

An endless conveyor (extreme left in Fig. 2) elevates the blanks from the bottom of the storage hopper to a gravity feed chute leading to a Gardner double-disc grinder, shown at the right. When the chute is filled, surplus blanks slide back into the storage hopper. Both thrust faces of each sun-gear blank are straddle-ground on this double-disc machine, maintaining the faces parallel and flat within 0.0005-inch total indicator reading and producing a surface finish of not more than 30 micro-inches.

Sun-gear blanks are pneumatically transferred,

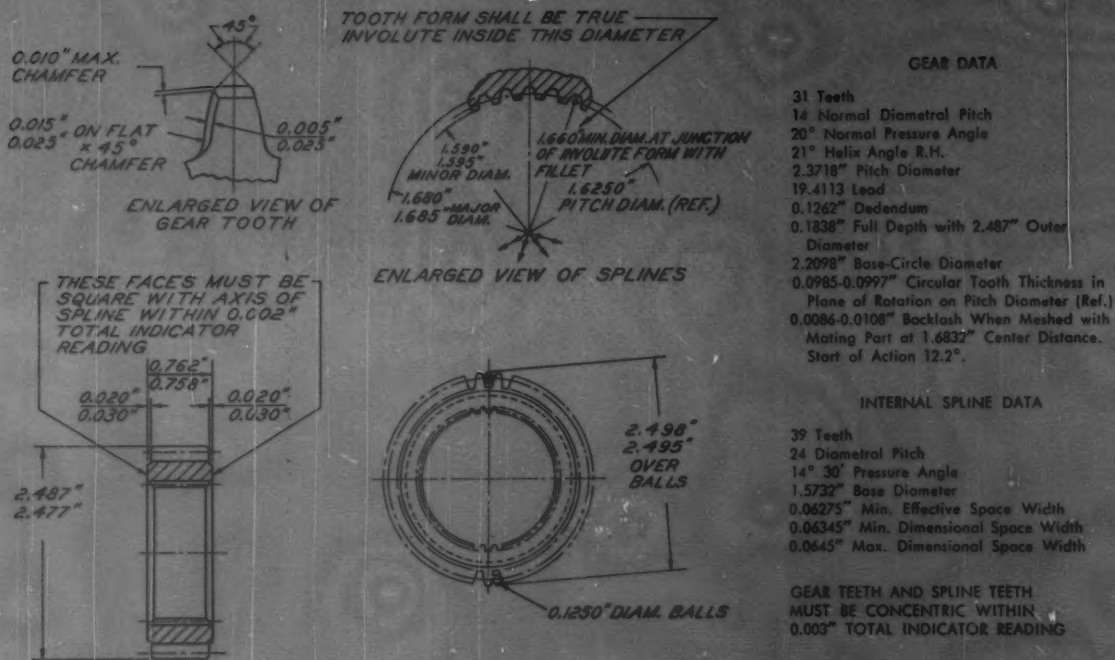


Fig. 1. Specifications of front sun gear for Hydra-Matic transmission. These gears are made from SAE 5140-H steel.

one at a time, from the gravity feed chute to U-slots in a twelve-station rotary carrier which passes between the opposed 30-inch diameter abrasive discs. A variable drive permits changing the rotary speed of the carrier to suit production requirements. Automatic size control is obtained by means of a Sheffield Lectrolair unit consisting of a Plunjet gaging cartridge and anvil. This control unit has a pneumatic dial indicator for setting up the machine and direct reading of the part size, and is used to energize signal lights and relays when the ground parts exceed the specified tolerances. Compensation for abrasive-disc wear is accomplished automatically by feeding the discs together when the thickness of several consecutive parts is gaged over size.

Vertical Storage Units Permit Uninterrupted Production

The ground blanks fall from the rotary carrier into another gravity chute, which leads to a storage and elevating unit, Fig. 3. This unit, made by the Leading Engineering & Mfg. Co., Pontiac, Mich., has a capacity for storing about 300 gear blanks—enough for continuing production for approximately an hour if the preceding disc-grinding machine has to be stopped for maintenance or

other reasons. Some of the access doors are shown open to illustrate how the blanks are moved slowly upward on a helical wire track by frictional contact with a rotating central drum.

From the top of the vertical storage and elevating unit, face-ground blanks are automatically fed to a Detroit Broach dual-ram, vertical machine seen in the heading illustration in which internal splines are broached in two parts at a time. The blanks slide into the chute seen at the lower right and are automatically pushed into cutting position below the two broaching tools. The parts are located in nests from one of the previously ground thrust faces and the turned peripheries. The axis of the thirty-nine internal spline teeth is held square with the thrust faces within 0.002-inch total indicator reading.

After being automatically unloaded from the broaching machine, the splined blanks pass into another vertical storage and elevating unit. This unit is similar to the one seen in Fig. 3 except that it combines a washing operation to remove broaching oil, chips, and other foreign matter from the parts. From the washer, gear blanks are automatically fed to a special deburring machine, Fig. 4, made by the Trio Tool Co. Here, the burrs formed on one end of the spline teeth in the preceding broaching operation are removed while

Fig. 2. Gear blanks produced on automatics are dumped into hopper (foreground), from which they are fed to double-disc grinder (right).

the blanks are rotated by means of a friction wheel as they roll past the wire brushes. It is necessary to keep the blanks aligned as they are transferred from the broach to the deburring machine, so that the proper side is exposed to the revolving brushes.

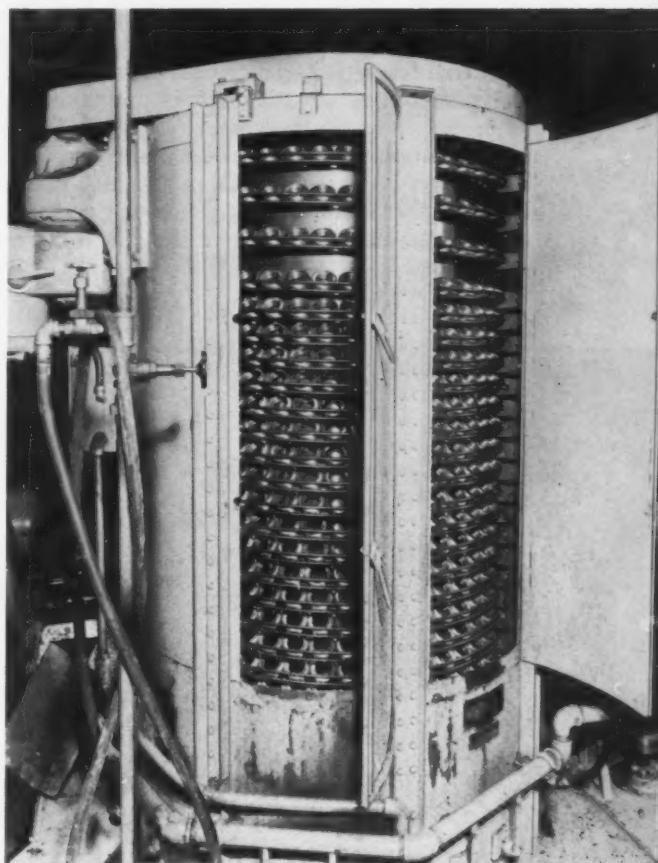
Distributing Unit Supplies Gears to Hobbing Machines

The gear blanks pass through another storage and elevating device before entering a distributing unit which automatically keeps a battery of twelve Cleveland hobbing machines continuously supplied with work-pieces. A two-level belt conveyor, extending the length of the two rows of six machines, has deflectors for directing blanks from the top level into the loading chute on each machine. When a chute becomes filled, the blanks are carried past the deflector to subsequent machines. In case one or more of the machines are inoperative, the distributing unit can be set to supply fewer pieces.

On each vertical hobbing machine, two gear blanks are automatically loaded at a time, as seen in Fig. 5. A solid arbor and hydraulically actuated pull-down type tooling locate and clamp the blanks. The arbor is hardened and ground to a diameter of 1.5908 inches, thus providing a slight clearance for the 1.591-inch minor diameter of the splines. A hydraulic pressure of 300 pounds is first used to push the arbor through the splined bores of the blanks. Then, a collet automatically grips the necked end of the arbor and—under 6000 pounds pressure—pulls the arbor into position. Each machine is equipped with an automatic gaging device.

When the thirty-one gear teeth on each blank have been generated, the parts are automatically unloaded—sliding down a chute onto the lower level of the belt conveyor running between the hobbing machines. From the conveyor, the front sun gears pass through an automatic inspection machine and a continuous feed type washing unit. Gears passing inspection are temporarily stocked in two more vertical storage and elevating devices. This backlog of parts eliminates shutting down the whole production line if one or more of the hobbing machines are stopped.

Fig. 3. Vertical storage and elevating unit receives gear blanks from disc-grinding machine. Doors have been opened to show helical tracks.



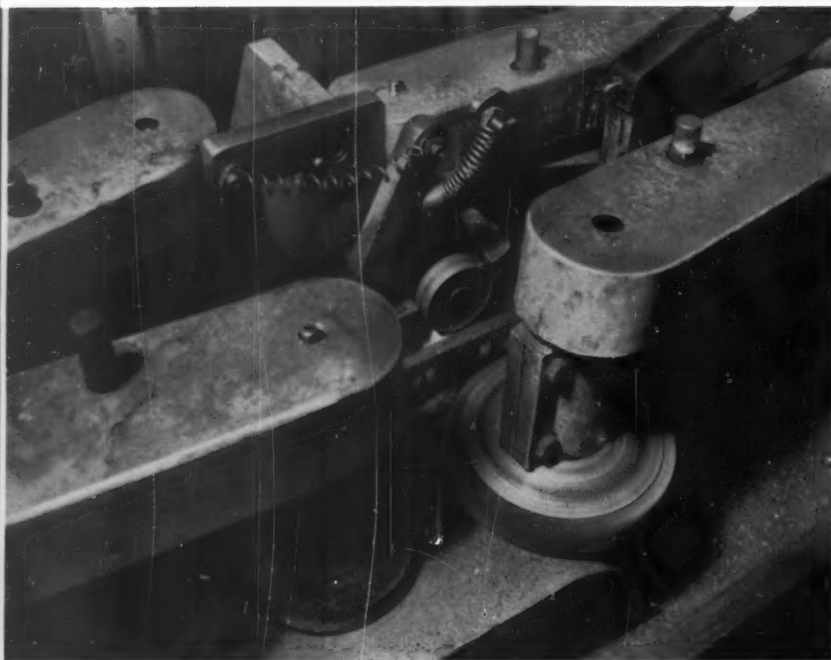


Fig. 4. Burrs formed on one end of spline teeth in preceding broaching operation are automatically removed by wire-brushing in this special machine.

The gears are then automatically loaded into either of two Burr-Master deburring and chamfering machines, made by the Modern Industrial Engineering Co. On these automatic machines, a disc picks up one gear at a time and slides it into the loading station. A chain-drive mechanism transfers the gear to the first work station, and an elevator raises it onto the spindle. Here, one side of each gear tooth is deburred and chamfered.

In transferring the part to the second station, the gear is rotated 180 degrees in a vertical plane, as shown in the center of Fig. 6. At the second station, the opposite sides of the gear teeth are finished. A maximum chamfer of 0.010 inch by 45 degrees is cut on the tip of each gear tooth, and a 0.020-inch by 45-degree chamfer is cut on each flat.

After being automatically unloaded from the

deburring and chamfering machines, front sun gears enter another storage and elevating unit. Then, the distributing device seen in Fig. 7, made by Michigan Tool Co., keeps three rotary shavers supplied with work-pieces. The space at the lower left has been provided for the addition of a fourth machine if production requirements make it necessary.

Each rotary type shaving machine is equipped with a gravity loader. From the distributing device, the gears travel down a chute and are transferred, one at a time, into a work-holder by means of an air-operated cylinder. The work-holder moves the gear into mesh with the shaving cutter, and the air-operated tailstock and center are advanced. When the shaving cycle is completed, the holder retracts, and the finished gear is removed from mesh and drops onto a chain con-



Fig. 5. Solid arbor and pull-down tooling locate and also clamp the gear blanks during hobbing. Two gears are hobbled at a time and automatically unloaded.

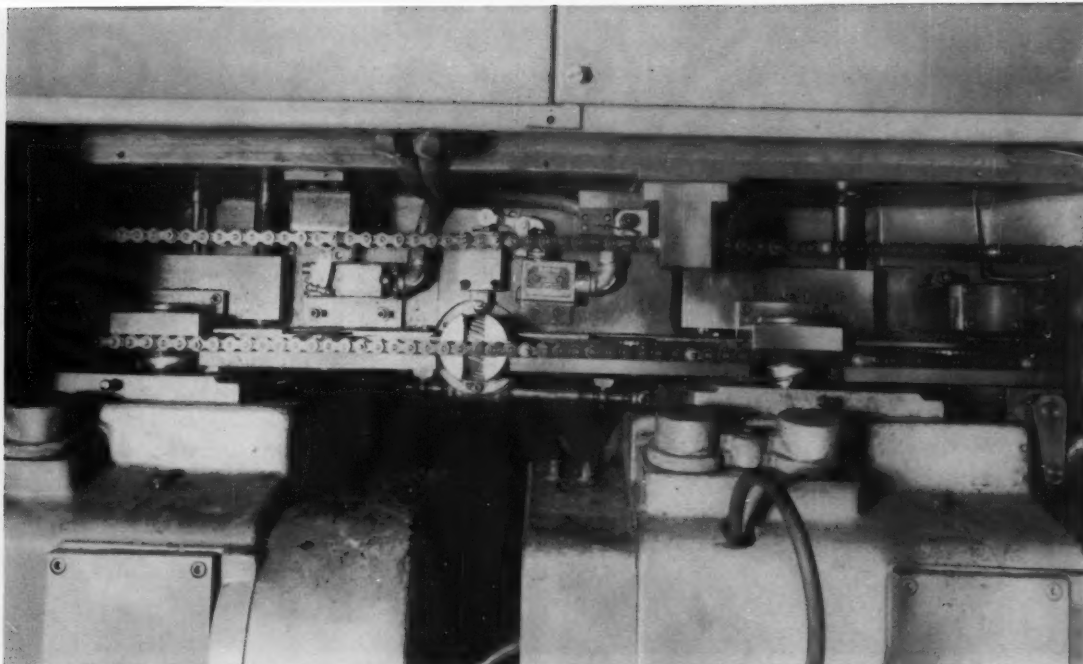


Fig. 6. Automatic, two-station deburring and chamfering machine. Work-pieces are rotated 180 degrees, as seen in center, between first and second stations.

veyor, Fig. 8, which carries it to the lower level belt of the distributing device (Fig. 7).

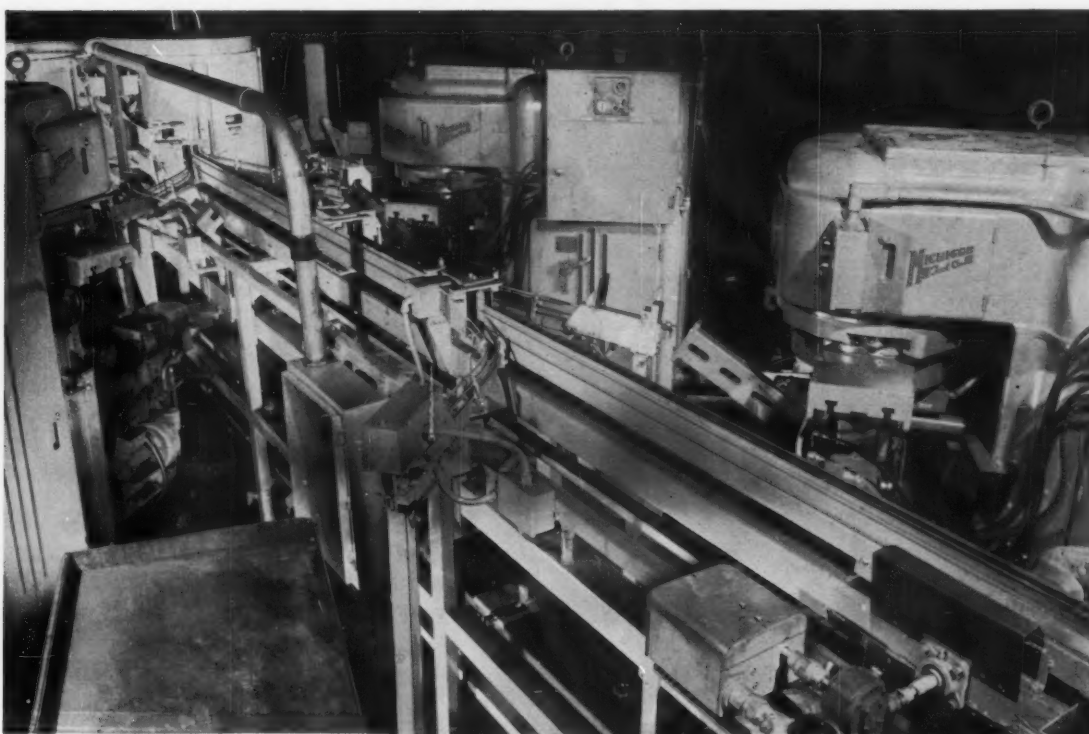
Heat-Treatment of Sun Gears

Shaved gears then enter a final storage and elevating unit, Fig. 9, which also combines a washing operation. Completely machined gears are inspected (using statistical quality-control meth-

ods) and manually loaded in baskets and placed on a roller conveyor leading to a Holcroft pusher type heat-treating furnace. The furnace is supplied with a controlled atmosphere consisting of an endothermic generator carrier gas (900 cubic feet per hour) mixed with natural gas (50 cubic feet per hour) as the carburizing agent.

Gears are heated at a temperature between 1525 and 1550 degrees F. for two hours and

Fig. 7. Distributing unit keeps three rotary shaving machines supplied with gears. The gears roll down a chute and are automatically loaded in machines.



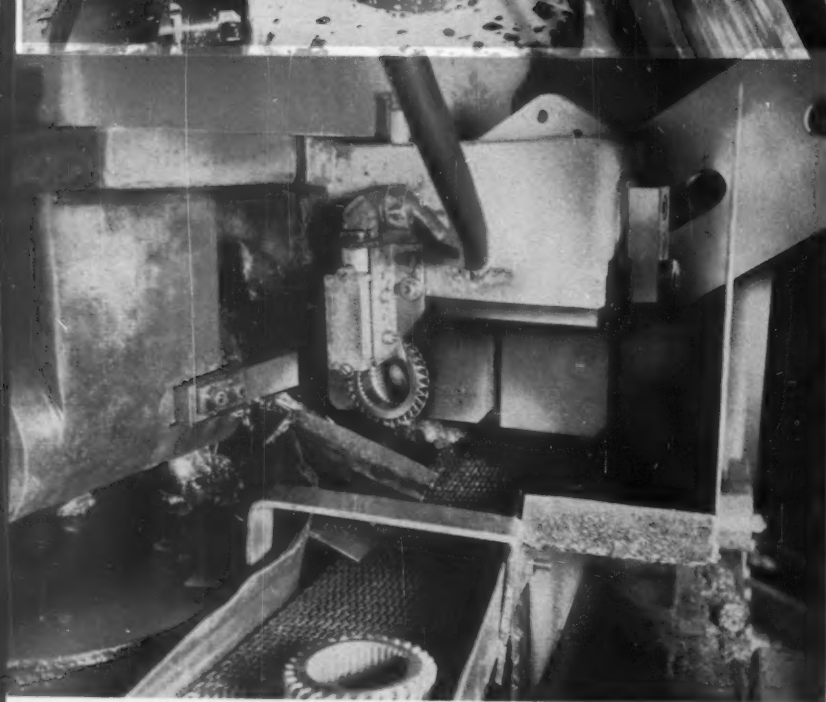
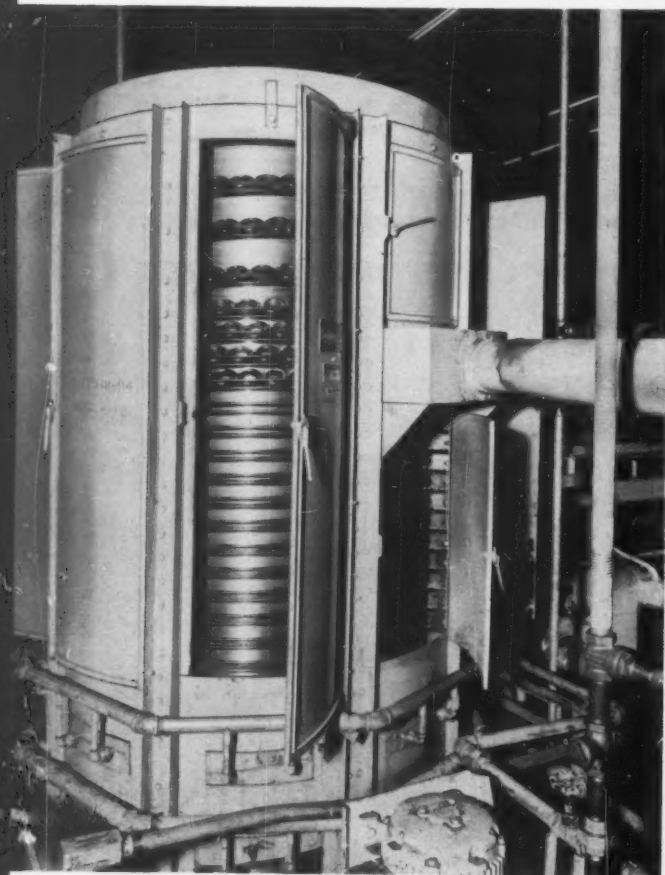


Fig. 8. Air-actuated workholder removes gear from mesh with shaving cutter and drops it onto a chain conveyor for transfer to distributing unit.

Fig. 9. Shaved gears are stored, elevated, and washed before being inspected and placed in baskets for carburizing, quenching, and tempering.



quenched in hot oil maintained at a temperature of from 300 to 350 degrees F. SAE 100 aircraft engine oil is used as the quenching medium. This modified martempering treatment minimizes distortion by slowing the hardening process sufficiently to allow uniform transformation from austenitic to martensitic structure. A fine-tempered martensitic case, from 0.005 to 0.010 inch deep and having a Rockwell hardness of about 58 C, has been found ideal for wear resistance and long life.

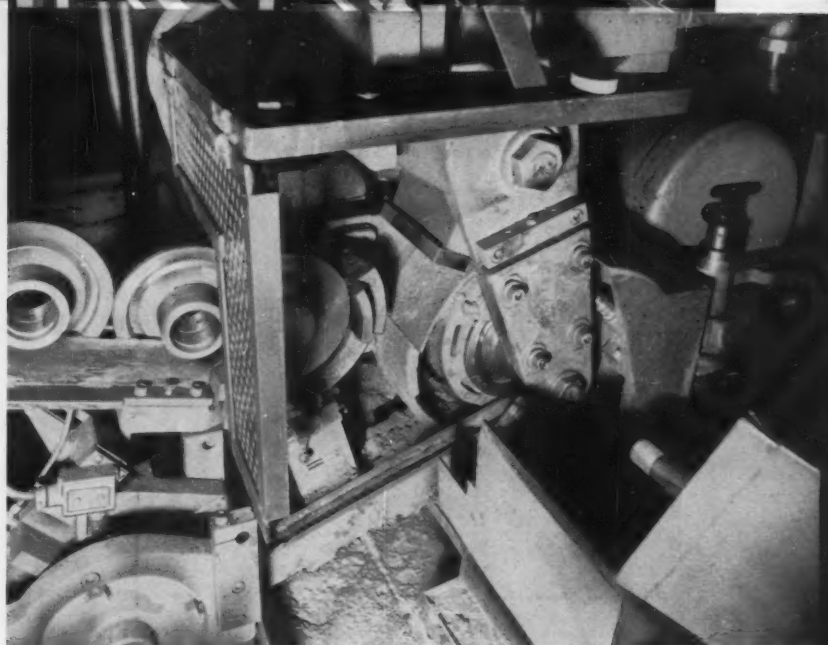
Hardened and tempered parts are cleaned by passing through a Vapor Blast machine. The presence of nicks or burrs which might cause noisy operation is detected by running the gears in a Red Ring gear speeder, made by National Broach & Machine Co. In this machine, the gears are run in both directions in mesh with another gear under load, and the operating sound level is noted. The final operation performed on the front sun gears is burnishing on a Fellows machine.

Rear Clutch Drum and Sleeve Assemblies Machined Automatically

Automatic processing at Detroit Transmission is not limited to small gears or symmetrical workpieces. For example, rear clutch drum and sleeve assemblies are produced in this way. Cast-iron drums and hardened steel sleeves are assembled in 35-ton presses which are automatically loaded and unloaded.

Assemblies are automatically loaded, one at a time, from a chute into Heald internal grinding machines—such as the one seen in Fig. 10—by means of a swinging arm. Here, the bores of the

Fig. 10. Clutch assemblies consisting of a hardened steel sleeve pressed into a cast-iron drum are conveyed from chute to chuck of internal grinder.

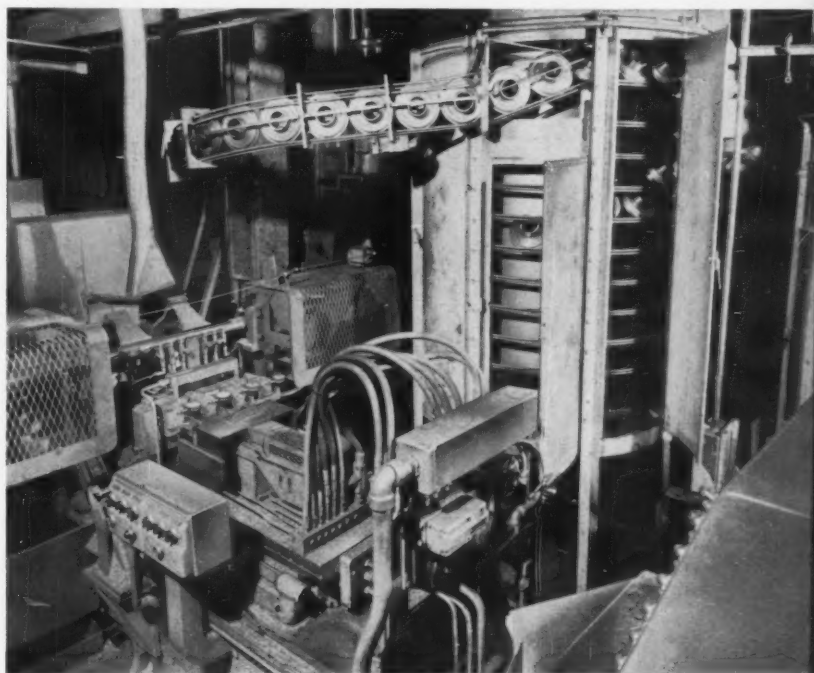


steel sleeves are finish-ground to a diameter between 2.0000 and 2.0015 inches. From the grinders, the assemblies are automatically loaded into one of three Heald nine-station transfer machines. At successive stations on these machines, eight holes are drilled in each part; the hub and sleeve end surfaces are turned, faced, and chamfered; two spots on each casting are end-milled; the hub end is bored and grooved; and, at the last station, bushings are automatically pressed into place and bored.

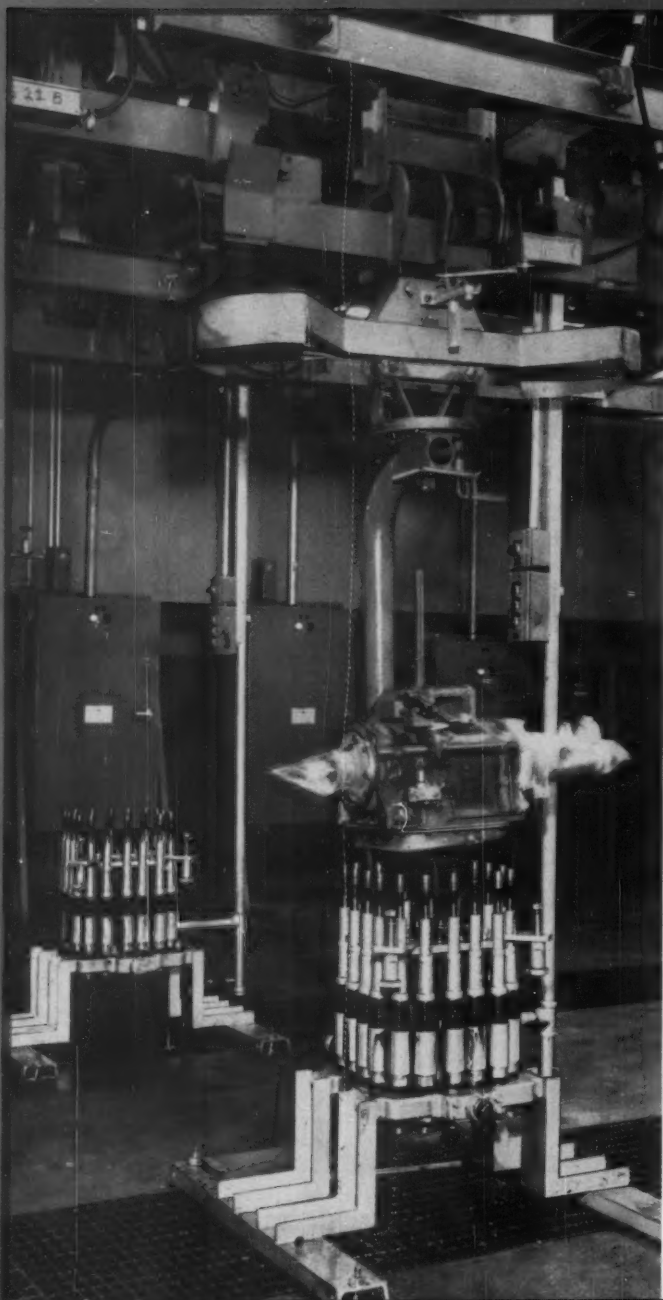
The eighth and ninth stations of one transfer

machine, where the bushings are bored and the assemblies automatically unloaded, are visible at the left in Fig. 11. Rear clutch drum and sleeve assemblies then enter a vertical elevating, storing, and washing unit (seen at the right), from which they are automatically loaded into a Micromatic vertical honing machine. Here, the piston sliding surface in the bore of the drum hub is honed to a diameter of 5.500 inches. Subsequent operations include broaching ten spline teeth on the periphery of each drum, grinding, burring, washing, and inspecting.

Fig. 11. Unloading end of nine-station transfer machine is seen at the left. Assemblies automatically pass from this machine through elevating unit at right to a honing machine.



NEW TRANSMISSION PLANT— AUTOMATION TO THE Nth DEGREE



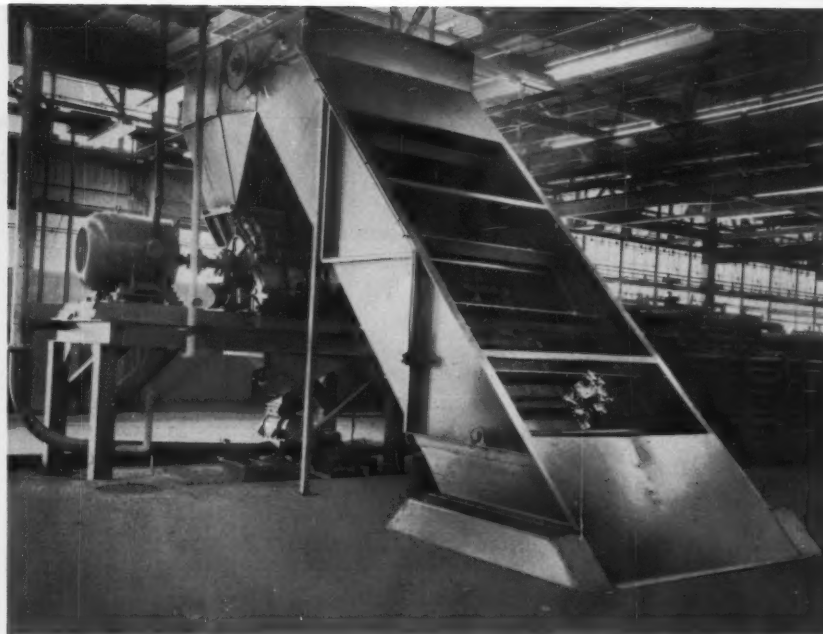
By WILLIAM MIRON, Plant Engineer, and
BRUCE FIELDS, Master Mechanic
Chrysler Transmission Plant
Kokomo, Ind.

A BRAND-NEW plant for a brand-new transmission! The "TorqueFlite" automatic transmission, now making its debut in Chrysler's entire 1957 line, fittingly is the end product of advanced automatic manufacture. At its newest facility at Kokomo, Ind., the company has instituted a host of processing "firsts." A few of them are recounted here.

Receiving and shipping docks are located at opposite ends of the building, providing a closer approach to a straight-line material flow than is generally found in the automotive industry. Steel, malleable-iron, cast-iron, and aluminum machining are performed in separate areas, involving 1139 machine tools and more than 5000 inspection gages.

A central coolant system is comprised of a network of eight trenches, or flumes, in the metal-cutting areas, having a combined length of over 1 1/2 miles. Coolant and chips from each machine are directed into one of the flumes. At one end of the plant, huge sep-

Fig. 1. Steel chips are seen moving up the elevator. After being chopped up, they are blown through ducts to railway gondola cars.



arators like the U. S. Hoffman equipment shown in Fig. 1 filter the coolant. Chips are automatically elevated from the flumes, chopped up (in the case of steel), and screw fed to a pneumatic blower. Chips are forced through ducts on the outside of the building, leading to railway gondola cars.

The segregation of manufacturing according to the metal involved is likewise carried to the point of keeping the flumes and separators independent of each other. When an engineering change involves a substitution of a malleable-iron part for one of cast iron (or vice versa), the machine tool is moved into the proper flume line. An added and novel feature is the handling of the clean coolant return by means of headers resting below the floor on shelves in the flumes. Overhead pipes and pipe drops to the equipment have been completely avoided.

The largest component of the automatic transmission is a cast-iron case. Two adjacent transfer lines, each 600 feet long, perform the machining operations. There are thirty-six transfer machines with a total of 276 actual working stations, supplied by eight different machine tool builders. Gross production rate is 220 cases per hour, with a total manpower requirement of thirty-seven men. A view of four BarnesdriL units on one of the lines is shown in Fig. 2. These machines perform a series of angle-drilling operations.

Coolant Used on Cast-Iron Transfer Lines

Machining of the case is done "wet"—a radical departure from the usual practice on a transfer line handling cast iron. All machines and fixtures have been provided with manifolds for the cool-

ant, and the chip chutes discharge directly to a flume between the lines. The pitch of the flume—necessary to induce the proper flow—would have required too great a depth at the low end, because of the length of the transfer lines. The problem was solved by pitching the flume in two stages; the first, to the mid-point of the lines, where an automatic pumping device elevates the coolant and chips to the second.

Sixteen material-handling units integrated in the two transfer lines function where needed to automatically raise, lower, turn, position, and load the work for subsequent operations. Machine-control gaging has been installed at strategic points. (In Fig. 2, a Federal Dimensionair can be seen between two of the drilling stations.) All cutting tools used are pre-set in the cutter-grinding department. Along the transfer lines, extensive use is made of tool storage boards and gage control boards. Tolerance charts and picture operation sheets (seen above each station) have incorporated in them complete processing information.

At the end of the lines, the cases are run through two special washing machines. The first machine washes, flushes, and blows off the entire case. The second machine, illustrated in Fig. 3, is designed with separate jets for each hole and dual stations for rinsing and flushing the case. This machine is also equipped with a special blow-off station and a station where three plugs are inserted automatically in the case, which is then tested for leaks under air pressure. The second station next accepts or rejects the part.

Advance planning did much to reduce the amount of deburring work on castings, one of the

universal bugaboos of metal-cutting operations. All faces and holes requiring machining are cast with integral chamfers. While this adds slightly to pattern and die costs, it eliminates or reduces deburring time. Another means of handling the problem of deburring is by subjecting the work to a blast of walnut shells. Intricate die-castings, like the aluminum valve bodies of the transmission, are deburred in this manner.

One of the outstanding automated operations in the plant involves the internal machining of the transmission intermediate shaft. A close-up view of the work as it enters this operation appears in Fig. 4. The equipment is a Krueger-Barnes special machine tool.

The shaft is a steel forging. Previously, external contours have been completed on tracer lathes and centerless grinders. Moving down a roller conveyor, the shafts enter a carrier which processes them in groups of six. In the first work station, gun drills enter both ends of the work, roughing out the bulk of the stock from the solid. All twelve gun drills operate simultaneously. At subsequent work stations, core drills open the hole, reamers bring it to size, and probes perform an automatic inspection.

The machine has its own cutting-oil system,

operating under 500 pounds pressure per square inch, because of the special requirements of cleanliness and surface finish. Chips, however, are discharged into one of the flumes of the plant's central system. To keep chips off the cutting tools, bristle brushes are located immediately ahead of the work-fixture bushings. The bristles are able to scrub the tools as they retract.

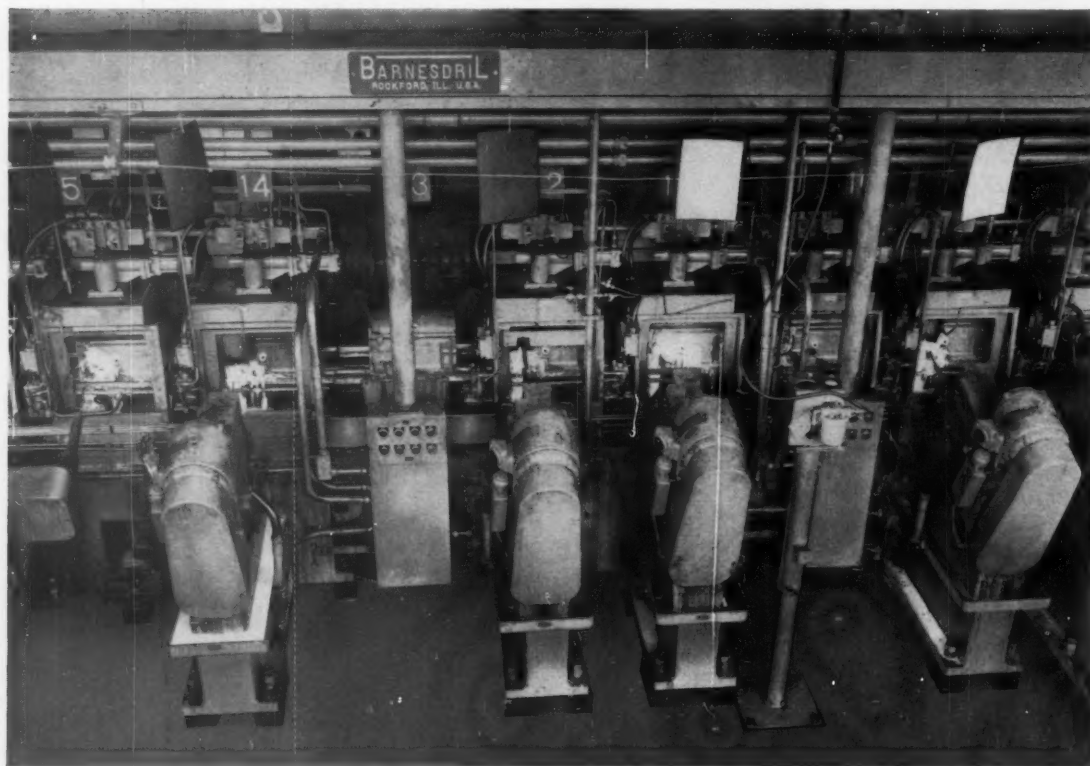
When cutting teeth in the integral flange of the intermediate shaft, Fig. 5, a plunge-hobbing technique is employed. Cleveland hobbing machines generate sixty-six helical teeth in the flange in a cycle time of only thirty-seven seconds. Loading of the work into hobbing position and its discharge are entirely automatic.

Swinging Gate Catches Gear Blanks

Much of the activity at Kokomo has been streamlined by simple, yet effective, "homemade" automation devices. A case in point is the first operation on a large internal (annulus) gear. Blanks are machined from tubing on four Acme-Gridley 6-inch bar automatics. A close-up view of one of these machines appears in Fig. 6.

The automation involved applies to the manner of catching the blank as it is cut off the tubing. In

Fig. 2. Part of a 600-foot long transfer line. One of its most unusual features is that it is operated "wet" for a cast-iron part.



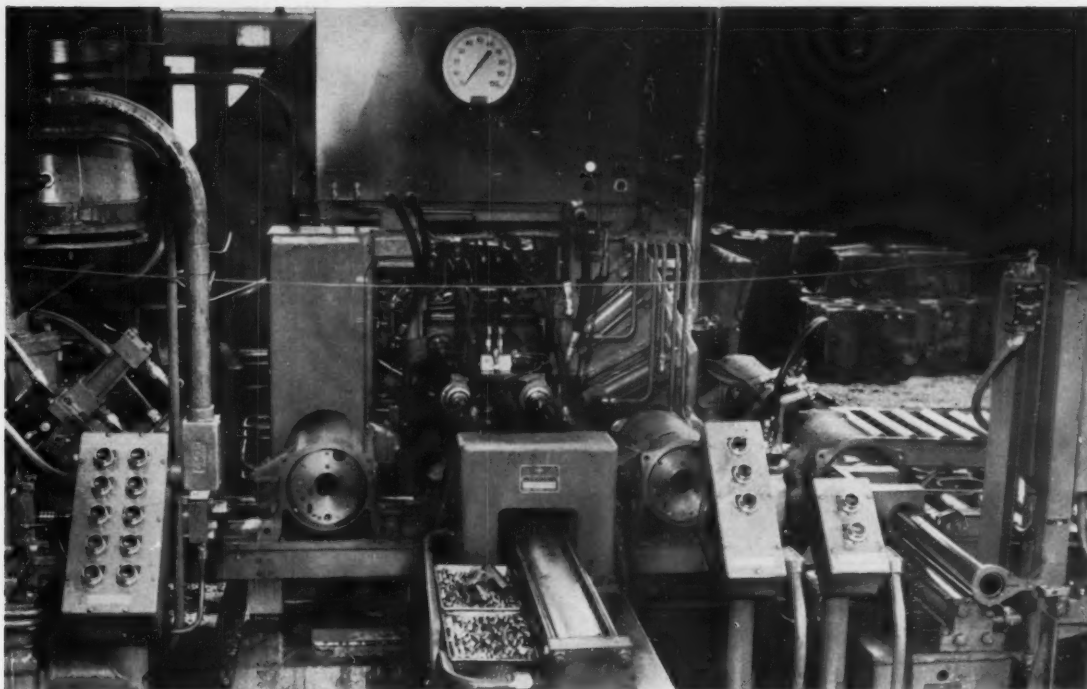


Fig. 3. When the cases are washed and pressure-tested for leaks at this station, their processing on the transfer line is completed.

the foreground of the illustration can be seen the runway leading to the discharge chute. The first section of the runway is hinged, and can be swung by the plunger seen at the right. During the machining cycle, this section is away from the work-spindle, as shown, where it does not obstruct the end slide or side slide. When the cut-off tool is about to sever the blank, the plunger swings the section to the spindle to catch the blank, then swings away, permitting the blank to roll down the runway.

In the next operation on the blank, internal helical teeth are broached on three large pull-down machines. Later, the acute sides of the teeth of the annulus gear are chamfered on fully automated equipment.

One of the most complete adaptations in mechanical handling is found in processing the planet pinion gears. The transmission contains six of these gears. Production approaches 1000 per hour. Blanks are produced on bar automatics, run through a washing machine, given an automatic inspection of the bore for size and taper, and then straddle-faced on special-purpose lathes. An automatic inspection of face squareness follows, after which the parts are directed into Lamb storage units.

These units contain spiral channels, down which the parts roll as needed. Fellows gear

shapers next cut the teeth, blow the part free of chips, inspect pitch diameter, deburr, and eject them onto a conveyor—all automatically. After passing through another storage unit, the teeth are shaved to size. Incorporated with the shaving is a unique operation which chamfers the outside diameter of the teeth to prevent the part from picking up pin nicks.

In-line heat-treating of the pinions includes a hot oil quench (modified martempering). A chamfer is ground on the acute tooth side, and the faces are honed flat and gaged. After passing through a third storage unit, the bore is automatically honed and gaged for size and taper.

Complete Gear Check in Seven Seconds

Grinding and honing burrs are removed by vapor blasting. Then, having passed through a final storage unit, the pinions enter the Illinois Tool Works gear checker (nicknamed the "juke box"), Fig. 7. Here, the work rolls down a chute and over one of several posts spaced around a dial table. The table then proceeds to index, bringing the work into mesh with a free-turning master at each of four stations. The first master burnishes and cleans the teeth; the second master checks runout, nicks, and tooth-to-tooth error; the third master checks lead error and angle velocity; and

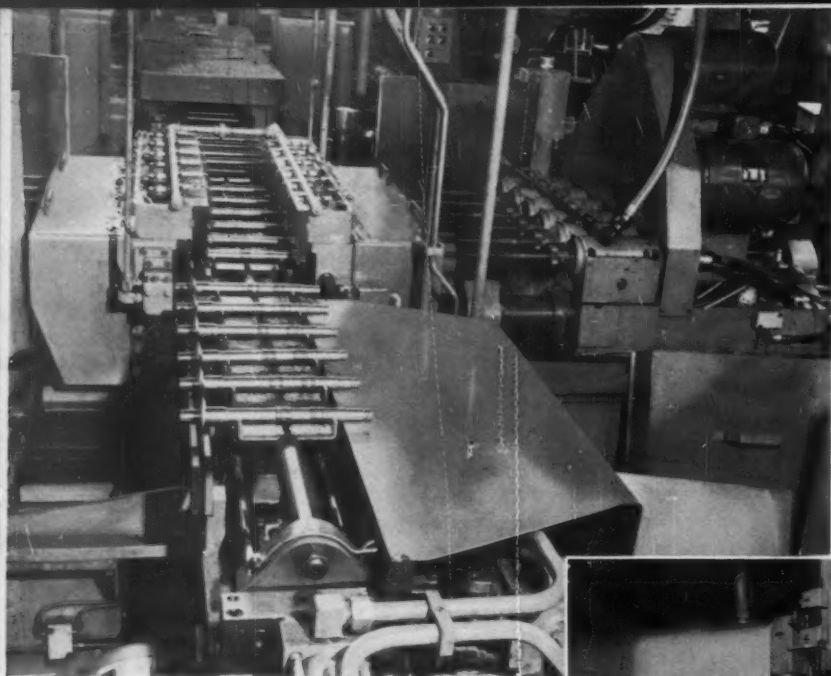


Fig. 4. (Left) Six intermediate shafts are gun-drilled at a time. Because of the small diameter of the hole, the chips are flushed out under extreme pressure.

Fig. 5. (Right) The teeth of a flange on the intermediate shaft are plunge-hobbed in a rapid cycle that includes automatic loading and unloading.

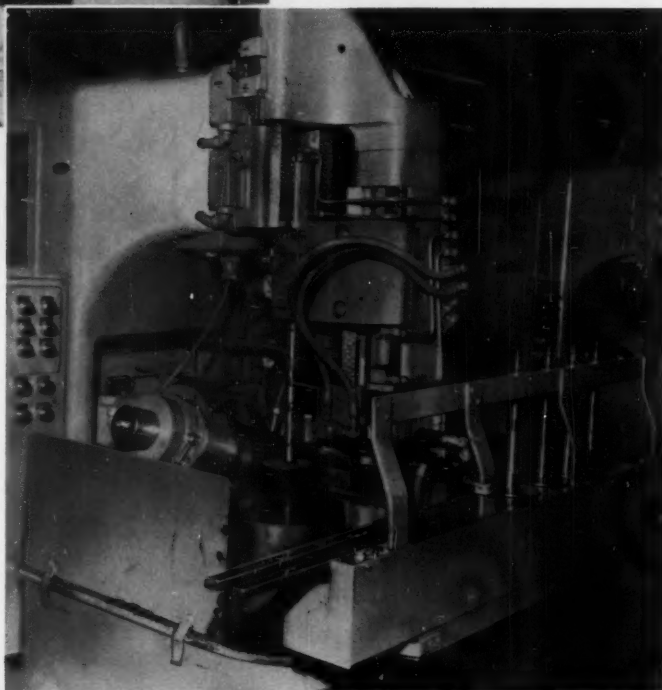


Fig. 6. (Left) The plunger swings the first section of the runway toward and away from spindle in time with action of cut-off tool.

the fourth master checks pitch diameter. Every seven seconds, a pinion is automatically ejected and classified in different chutes for acceptance, salvage, or scrap.

The continuous machining of both faces of die-cast aluminum valve bodies is performed on Heald machines with automatic clamping and unclamping features. This operation is illustrated in Fig. 8. Work-pieces are loaded into the stations of a circular fixture which is in continuous rotation. A clamp at each station is cam-actuated, automatically opening as the front of the machine is approached, so that a completed valve body can be unloaded and a new one loaded.

As each station leaves the front of the machine, its clamp automatically closes. Behind the fixture are two opposed Heald Bore-Matic heads carrying fly cutters on their spindles. As the work-pieces are rotated to the rear, they intersect the paths of the cutters, which are set apart an amount equal to the required distance between the faces.

Revolving Fixtures Expose All Surfaces in Shot-Blasting

After heat-treatment, a variety of transmission components travel through the shot-blasting cabinet seen in Fig. 9. To expose all surfaces of the parts to the blast, racks are supported by fixtures which revolve. The fixtures, driven around a monorail loop, have a free-turning shaft to which is pinned a large sprocket. Directly above the cabinet is fixed a section of chain. As each fixture enters the cabinet, its sprocket engages the chain and is made to revolve during its travel through the shot-blasting cabinet.

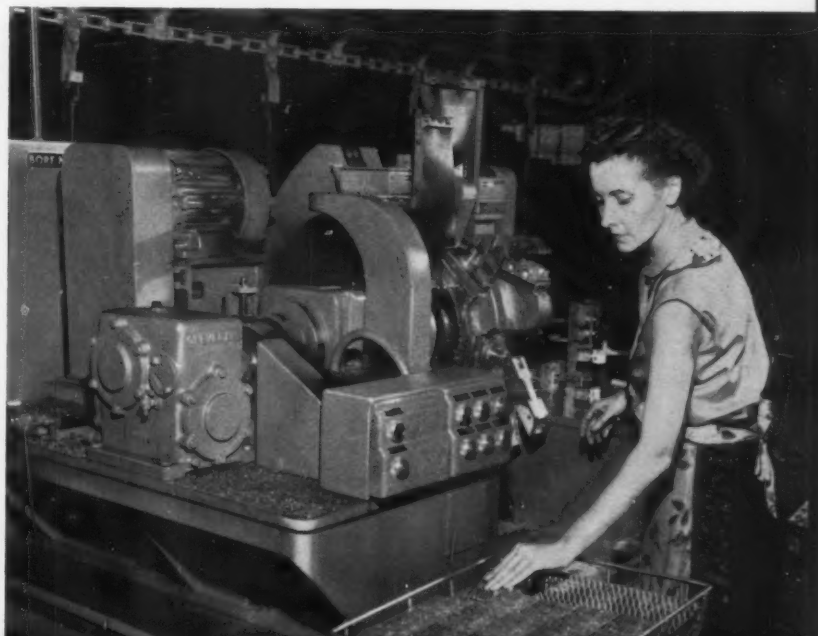
Facilities for the storage of parts awaiting as-



Fig. 7. The pinion gears are loaded, teeth inspected at four stations, classified, and ejected—without human intervention.

sembly are claimed to be unique for automotive manufacturing plants—yet they are extremely simple. A view of the storage area is shown in Fig. 10. It can accommodate 10,000 of each part. All parts are contained in baskets which are stacked on skate-wheel conveyor sections. There are eighty of these sections.

Fig. 8. Both faces of valve body are machined in a continuous cycle. Clamping and unclamping are performed automatically.



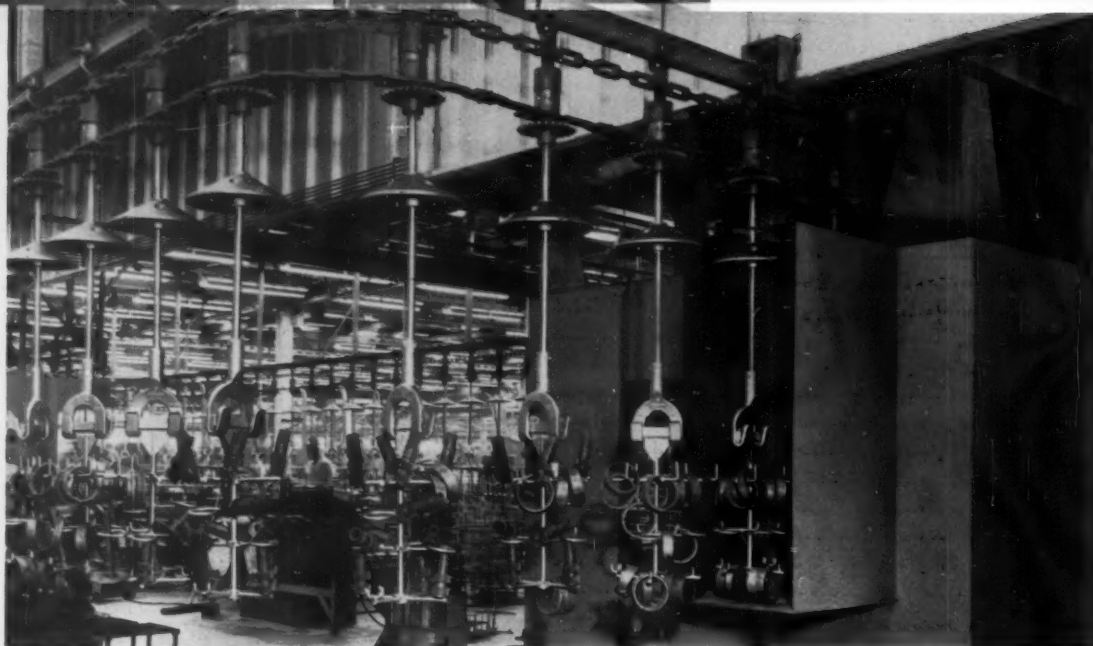


Fig. 9. When the sprockets engage the chain section over the cabinet, the work is revolved, assuring that the shot blast reaches all surfaces.

Each section is pitched down from the loading end to the discharge end, toward which the baskets roll by gravity. This permits automatic stock rotation, since the oldest stock is always used first. A monorail conveyor loops the storage area, the assembly area, and the terminal points of the production lines. Baskets are directed onto the conveyor from the discharge ends of the skate-wheel sections, and travel to the assembly area where they are unloaded. At the terminal points of the production lines, they are reloaded and then removed at the loading ends of the sections. It is possible to store all of a particular part

number on the same section, so that the counting of parts is simplified.

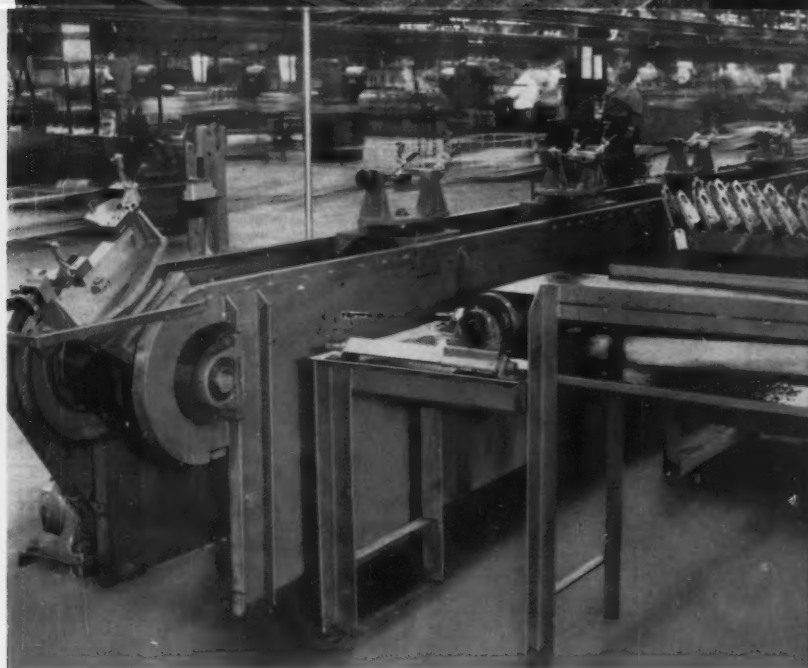
The assembly area, too, reflects the theme of automation of the transmission plant. An illustration is the assembly of the valve body. Quick-acting work fixtures are spaced on an endless chain directly in front of the assemblers. As the fixture passes by, each assembler adds a particular part or performs a particular operation on the valve body.

A view of the fixtures is shown in Fig. 11. This is at the end of the line, and the assemblies have already been unloaded. The fixture at the extreme

Fig. 10. In the storage area, parts are brought in at one end, taken out at the other, thus assuring that the oldest parts are used first.



Fig. 11. The assembly fixtures cycle around on an endless chain. Assembly is progressive, a specific function being performed by each worker on the line.



left is in the process of descending for the return trip under the table to the start of the line, where it again goes into use.

Case Pan Bolted Automatically

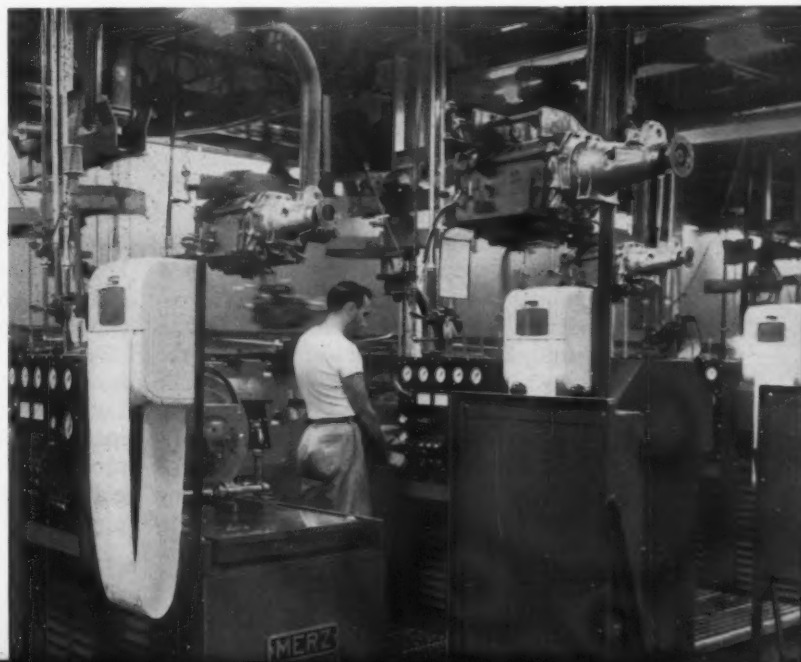
Another interesting station in the assembly area is the one where the pan is bolted to the bottom of the transmission case. While the case remains inverted from previous assembly steps, the pan is positioned, and the eighteen bolts required are started manually in their respective tapped holes in the case. Then, the assemblies are turned right side up and shunted onto monorails leading to one of the two bolt-runners seen in the heading illustration. When directly over a bolt-runner, an air cylinder automatically lowers the assembly

into the nest formed by the eighteen wrench sockets of the bolt-runner.

As the assembly floats into the nest, the sockets engage the bolt heads and tighten them to a preset torque. The air cylinder next raises the assembly, and the conveyor advances it to a storage area. No labor at all is required here, either in handling the work or in actual bolt-running.

During major assembly, the transmissions are shunted into a testing room, Fig. 12. Here, they undergo a 100 per cent performance check on a battery of sixteen Merz test stands. When the transmissions enter the room, they are automatically distributed to the various stands as needed. Above each stand is an elevator which engages and positions the transmissions. The complete test is run from a panel.

Fig. 12. Transmissions are automatically directed by controls on the conveyor to the sixteen test stands as needed.





SHOCK absorbers for all General Motors vehicles are produced by the corporation's Delco Products Division at Dayton, Ohio. While most shock absorbers operate on the same general principle, each automobile manufacturing division requires its own version of the item. This is necessary because the various makes of automobiles have different proportions, weights, and desired riding "softness."

The operating principle of the shock absorber, a non-adjustable, direct-acting hydraulic type, is explained in Fig. 1. There are three concentric tubes, known as the cylinder (inner) tube *A*, the reservoir tube *B*, and the dust (outer) tube *C*. The cylinder tube contains a piston-rod *D* and piston assembly *E*. In the top of the cylinder tube is pressed a rod guide and seal assembly *F*. The lower end of this tube holds an intake and compression valve assembly *G* which admits the hydraulic fluid into the reservoir tube.

In the drawing, the piston is shown descending in a compression stroke. The small arrows indi-

cate the flow of the fluid. During the descent, the fluid is forced through small holes in the piston head, flowing from lower chamber *H* to upper chamber *J*. Because the rod occupies an increasing amount of space in the upper chamber, not all the fluid can be accommodated. Some of it is forced out through the compression valve assembly *G* into the reservoir tube.

On the rebound, the car body moves away from the car springs. The piston is pulled upward, and the fluid in the upper chamber is forced back to the lower chamber. Also, fluid returns to the lower chamber from the reservoir tube through the intake valve assembly.

Shock absorber manufacture consumes about 40 miles of tubing each sixteen-hour day. Tubing is of cold-formed and resistance-welded construction. One of the Abbey-Etna mills on which nominal 1-inch cylinder, reservoir, and outer tubes are made can be seen in Fig. 2. Tubes originate as coils of flat stock and pass between a series of opposed rolls, gradually obtaining a circular cross-

FORTY MILES OF TUBING— A SHOCK ABSORBER PLANT'S DAILY DIET

By EDGAR ALTHOLZ, Associate Editor

section. The cylinder tube has a 1 3/16-inch outside diameter and 0.070-inch wall; the reservoir tube, a 1 5/8-inch outside diameter and 0.042-inch wall; and the dust tube, a 2 1/32-inch outside diameter and 0.035-inch wall.

When fully formed, the tube passes under a large copper-alloy electrode wheel, between a pair of squeeze rolls, Fig. 3. The electrode rotates slowly under a flood of coolant, butt-welding the seam. The welder is rated at 75 K.V.A. and uses alternating-current power of 180 cycles. Upon emerging from the wheel, the flash along the outside and inside of the seam is removed automatically by two small cutting tools.

Mill running speeds for the pressure, reservoir, and dust tubes are 90, 95, and 120 feet per minute, respectively. After traveling through a cooling trough and a series of sizing rolls, the tubes are cut off in 20- and 30-foot lengths by a flying shear.

The cylinder tube—the most critical of the three—goes through additional cleaning, heat-treating, and sizing steps. First, a machine, illustrated in Fig. 4, chamfers both ends and removes excess loose metal from inside the tube. After tubes are loaded in a chute, the machine automatically feeds one tube at a time into a chamfering station, then into a second station, where a ramrod having a wire brush at its end is pushed through the tube, forcing the shavings ahead into a chip chopper.

Next, the tube is flushed with a blast of compressed air and water. Then, one end is swaged to a reduced diameter to provide a lead for a subsequent draw-bench operation.

Passing through a 100-foot electric furnace, the cylinder tubes are annealed. This removes any hardness developed as a result of cold-forming in the tube mill as well as hardness caused by the quenching of the weld.

Tubes advance through the heating and cooling sections of the furnace at a rate of 1 foot per minute. To assure a bright, scale-free surface, cooling is done in a controlled atmosphere. In Fig. 5, a batch of tubes has emerged from the furnace and has tripped an automatic unloader which tilts the work forward, causing it to roll down into the rack in the foreground.

Pickling and lubricating of the tubes follow. From the furnace unloading rack, tubes are transferred in bundles of forty-five to fifty by a traveling crane to the processing tanks. In the first tank, the tubes are immersed in an acid cleaning and pickling bath. The second tank is a clear water rinse. After the clear water rinse, the tubes are immersed in a hot solution of drawing lubricant.

The wall of the cylinder tube is next brought to proper thickness and finish on draw-benches like the one shown in the heading illustration. Area reduction of the wall is approximately 30 per cent. The Vaughn machine illustrated draws two tubes at a time at 120 feet per minute.

Tubes are loaded over mandrels having a carbide nib on the end. The mandrel carrier then is indexed 180 degrees to align the mandrels with carbide ring dies. As the mandrels are pushed forward, the swaged end of the tubes is able to enter the dies, and extend for 4 inches beyond the die post.

At this point, the puller head advances on its

ways, gripping the two tubes in split collets and drawing them through the dies. Then the puller head backs off, and arms, arranged in a row, catch the tubes and slide them forward onto a rack. Inside diameter tolerance is held to 0.001 inch.

Reservoir and dust tubes are cut off to required lengths on Grieder machines. Rubber feed-rolls drive the tubes into clamping dies which hold

them rigidly. A cutter on a horizontal slide notches the top wall of the tube. Then another cutter on a vertical slide enters the notch and completes the cut-off. The machines have a production rate of 6000 pieces per hour and can hold lengths to within 0.010 inch.

In the wall of the reservoir tube is an integral helical groove which produces a swirling movement of the fluid. Sudden surges of oil in the shock absorber are thus prevented. A battery of ten machines rolls the groove into the tube. One of them is shown in Fig. 6. After a tube is loaded into a chute above the machine, the operation is entirely automatic.

A hydraulically operated loading arm transfers the tube to the work-center of the machine. Then a hydraulic cylinder moves the tailstock center into the tube and thrusts the tube into an air chuck on the headstock spindle. This is a three-jaw compensating chuck which grips the work over a stud. While the spindle (driven by a fluid motor) rotates the tube, a carriage supporting three forming rolls produces the helix.

The carriage is geared to the spindle by a double screw to produce a 1 1/4-inch lead. A hydraulic cylinder forces the rolls into the tube. The rolls are of different diameter and are disposed at different angles to conform to the desired helix. When grooving is completed, the spindle and carriage stop, the tailstock center retracts, and the tube is ejected by a stripper operated with the opening of the chuck jaws. The tube then drops onto a conveyor. Production per machine varies from 450 to 825 pieces per hour, depending on the tube lengths.

A variety of springs and bushings, washers, cages, and other screw-machine products are found in the shock absorber. The intake and compression valve assembly for the 1-inch direct-acting shock absorber consists of a cylinder end, valve cage, valve stem, valve compression spring, retainer, and valve intake spring. The assembly of these six parts is semimechanized. The machine involved has double tooling—identical sets on each side—permitting assembly of two valve models simultaneously.

There are thirteen stations on each side of the machine. Four of the parts enter the lines from vibratory feeders. The two springs are hand fed. Controls are interlocked, allowing any operator to stop the machine. In addition to the feeding stations, other stations perform functions of checking for missing parts, crimping, stamping a

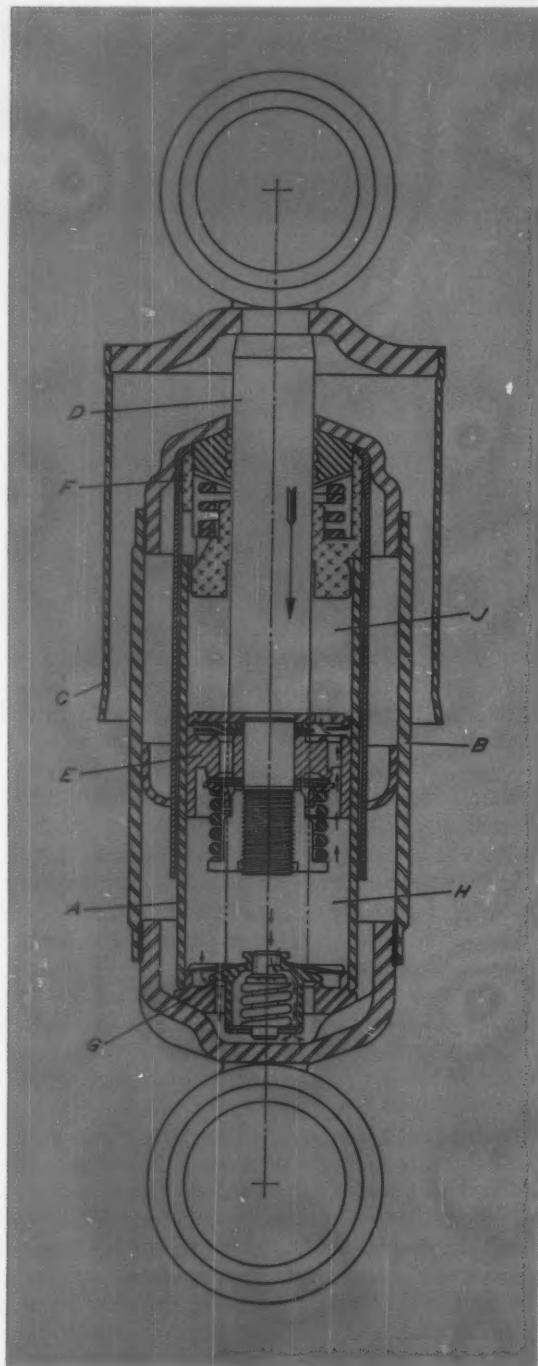


Fig. 1. On the compression stroke, fluid is forced from lower chamber (H) to upper chamber (J) and reservoir tube (B).

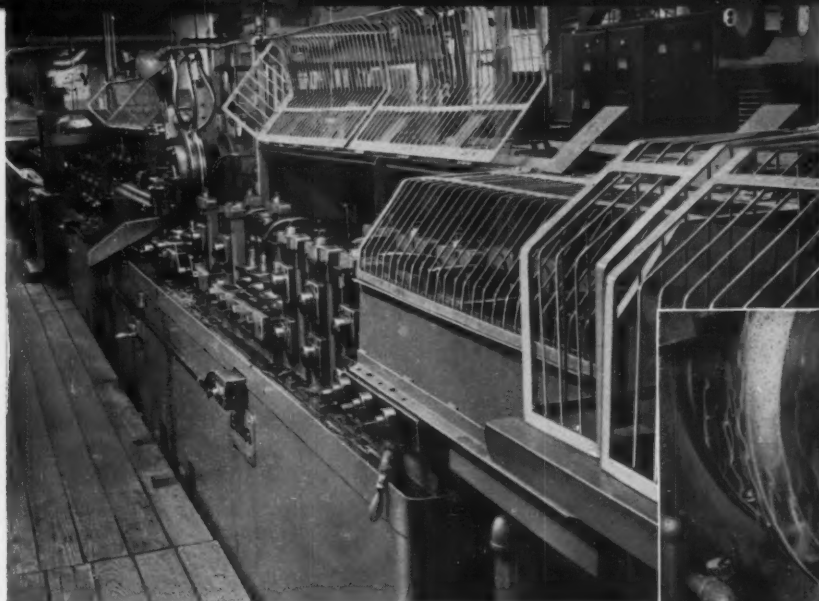
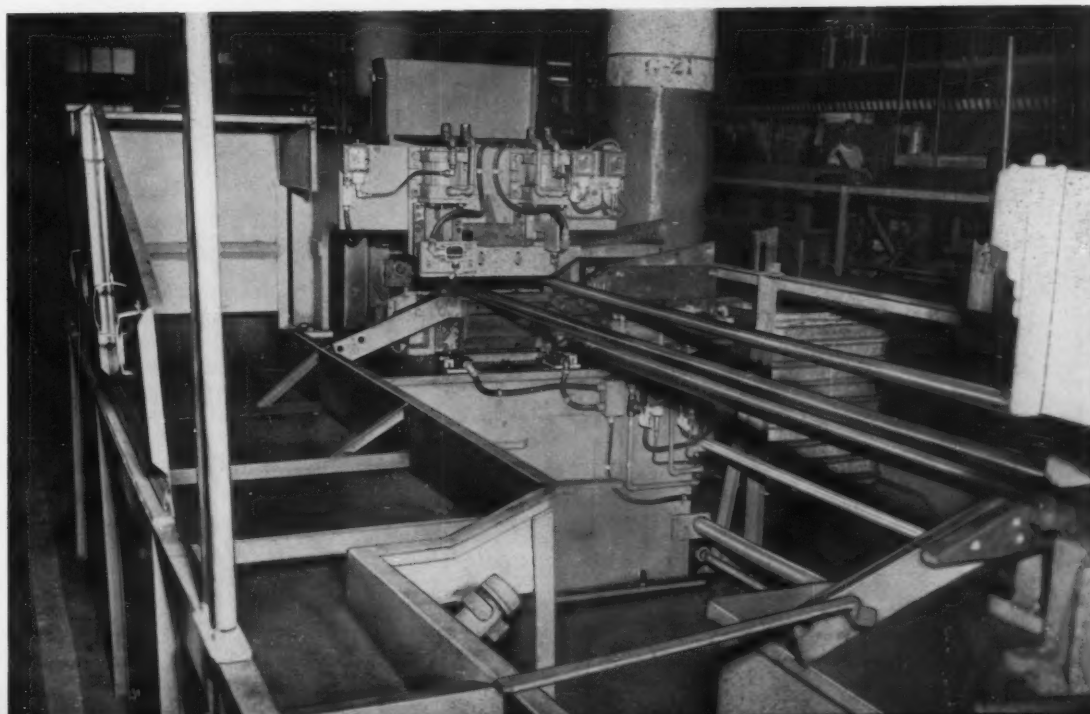


Fig. 2. (Above) This mill cold-forms and welds continuous lengths of strip into tubing. Guard has been removed to show the forming operation.



Fig. 3. (Right) Upon leaving the electrode, the welding flash is cut off automatically. The guard has been removed to show details.

Fig. 4. (Below) This special machine chamfers the ends of the tube and cleans the inside with a wire brush ramrod.



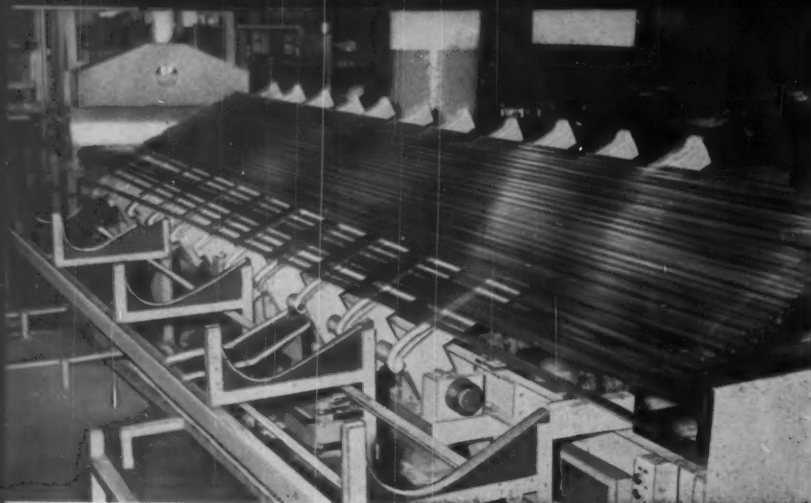


Fig. 5. (Left) When a batch of tubes emerges from the furnace, it is automatically tilted forward for unloading.

Fig. 6. (Right) A helix is rolled into reservoir tube to avoid surging of the fluid in service. The guard has been removed to show details.

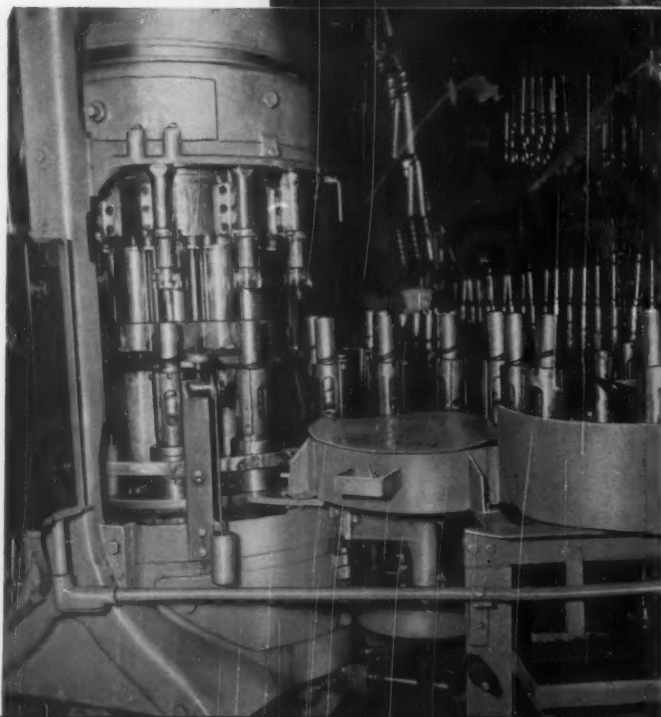
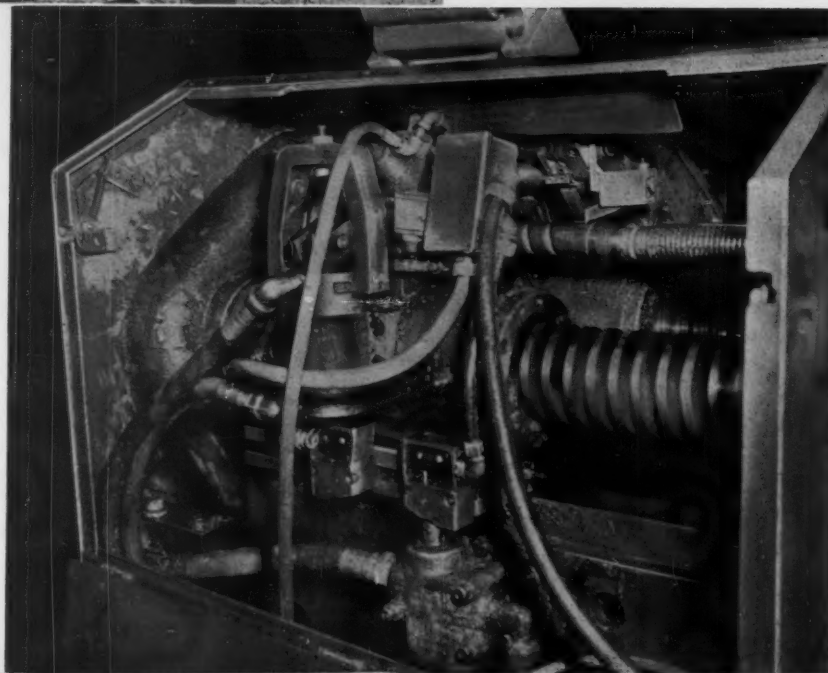
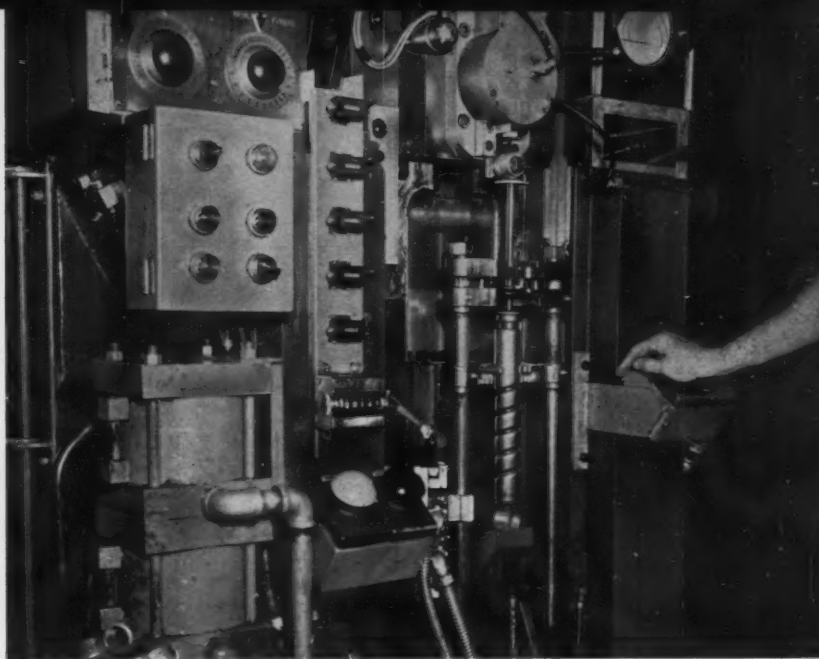


Fig. 7. Shock absorbers are filled with a specified amount of hydraulic fluid as they rotate about machine column. Guard removed to show fixtures.

Fig. 8. Prior to final welding, shock absorbers are tested electronically. The cathode ray tube can be seen in the upper right corner.



code number, coining, inverting the work, and finally ejecting it.

One important step in assembling the shock absorbers, of course, is filling each unit with hydraulic fluid. This is done on the bottle filler shown in Fig. 7. The machine is an adaptation of the kind found in the food-processing industries.

Shock absorbers travel in cylinder fixtures on a conveyor from other points in the assembly area. As they approach the bottle filler, a spider wheel engages the fixtures and causes them to rotate

around the machine column, then automatically returns them to the conveyor. During the rotation, each assembly is filled with fluid from an individual tap located directly overhead.

Volume is adjustable by setting a dial, from 87 to 229 cubic centimeters for the twenty-eight different amounts required by the various shock absorber models. It is possible to hold the volume to plus or minus 1 cubic centimeter.

Before the top of the shock absorber is sealed by welding, each unit is checked dynamically through a series of compression and rebound strokes. The electronic press performing this test is shown in Fig. 8.

While the shock absorber is reciprocated at a predetermined speed, the instantaneous force developed is indicated as a horizontal displacement of a spot on a cathode ray tube. The spot is swept vertically by a signal which is proportioned to time. On a transparent mask over the cathode ray tube are scribed high and low limits.

Resistance welding is employed for jobs like joining studs or rings to the piston-rod on top of the shock absorber, and for securing the dust tubes. In Fig. 9, a Taylor-Winfield dial-feed machine performs the latter operation. After the shock absorbers are loaded from a conveyor, they are indexed around the machine. The six spot-welds required on each shock absorber are made simultaneously by three pairs of hydraulically operated guns. A Geneva drive for the dial-feed table operates at 1500 indexes per hour.

Fig. 9. Six spot-welds are made simultaneously to fuse the dust tube to the shock-absorber assembly.





HOW

INDEPENDENT automotive parts suppliers still face the threat of continually diminishing business because their customers—automobile and truck manufacturers—are producing more and more components for their finished products and, consequently, buying less. Long Manufacturing Division of Borg-Warner Corporation hopes to stem the tide of this integration by car and truck makers with a bold, recently completed modernization program that necessitated the expenditure of \$2,000,000.

According to figures compiled by the Automotive Parts Manufacturers Association, approximately 10 per cent of the suppliers that were in business a decade ago have now closed their doors. Undoubtedly, part of this mortality is due to the inability or unwillingness of the concerns to risk their capital on expansion or new equipment to keep pace with the automotive industry's severe cost competition. Long firmly believes that the major hope of survival is in producing new, improved, and better quality components at com-

petitive prices. Hence, the extensive modernization program plus doubling of the budget appropriated for engineering.

Automatic Fluxing and Soldering of Radiators

Major improvements in radiator manufacturing facilities included the installation of automatic fluxing and soldering machines, and electrostatic paint booths. Radiator tubes are formed on Kane & Roach tube-mills which operate at the rate of 280 feet per minute. Brass strip stock supplied to the mills in coil form varies from 0.0045 to 0.008 inch in thickness, depending on the requirements of the radiators.

The mills fold the brass strip almost double and join the open ends into an edge lockseam. Formed tubing automatically passes through a zinc-chloride flux bath and into a pot of molten solder, where it receives a 0.001-inch coating containing 25 per cent tin and 75 per cent lead. The coated

AN AUTOMOTIVE PARTS SUPPLIER

MEETS "CUSTOMER COMPETITION"

Automatic fluxing and soldering machines, electrostatic paint-spraying booths, special welding equipment, induction-hardening units, and material-handling systems are included in the \$2,000,000 modernization and development program described in this article.

**By CASS E. DOMBROWSKI, Vice-President of Manufacturing
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Detroit, Mich.**

tubing slides into a trough and is cut into 50-foot lengths. These lengths are subsequently sawed into core-size pieces varying in length from 5 inches for car heaters to 36 inches for bus heaters.

Radiator fins are stamped from coils of copper or aluminum strip stock varying from 0.00275 to 0.010 inch in thickness, and from 1 9/16 to 4 inches in width. The Bliss 60-ton press seen in Fig. 1 is equipped with a double die and operates at sixty-five strokes per minute to produce 130 fins per minute. The fins are pierced, extruded to form the flanges for receiving the tubes, and cut off to the required length. One man can easily attend two presses. Henry & Wright 50-ton dieing machines are also used, with single or double dies, to stamp shorter fins (5 to 16 inches long) at rates up to 160 per minute.

One operation that has defied automation is radiator-core assembly. This is accomplished by skilled operators who place the copper fins into the grooves of a fixture called a stringing machine. The bottom header, an alignment mandrel, the tubes, and the top header are then added successively, and the core assembly is placed on hangers suspended from an overhead conveyor. Core assembly time varies from four to eight minutes, depending on core size.

The conveyor carries the core assemblies through a special Long-designed, automatic fluxing machine. A detergent type agent wets the copper, and a zinc-chloride solution cleans and

removes oxides and foreign particles that would prevent good soldering. As the assemblies emerge from the bath, the cores are automatically tilted to hasten draining. Then they are manually removed from the conveyor and placed in ovens, where they are baked at a temperature of 550 degrees F. for about one minute. This joins the tubes to the fins by melting the solder previously applied to the tubes.

After baking, the cores are again placed on the conveyor and carried to special flux-spraying units which prepare the top and bottom headers for soldering. On the automatic header-to-tube soldering machine seen in Fig. 2, a preformed strip of solder (38 per cent tin-62 per cent lead) 0.015 to 0.020 inch thick is manually placed over the tubes projecting through the header. About eight core assemblies are placed on the machine at once, and a chain-driven head carrying from one to five gas torches is traversed over the assemblies (at the rate of 40 inches per minute) to melt the solder and join the tubes to the headers. The number of torches used varies with radiator design and the thickness of the tubes, fins, headers, and solder. Premixed propane is burned in the torches. A blast from a compressed air nozzle cools the solder. When one end has been soldered, the assemblies are reversed on the automatic soldering machine, and the opposite headers are joined to the radiator tubes.

Bottom and top tanks of the radiators are

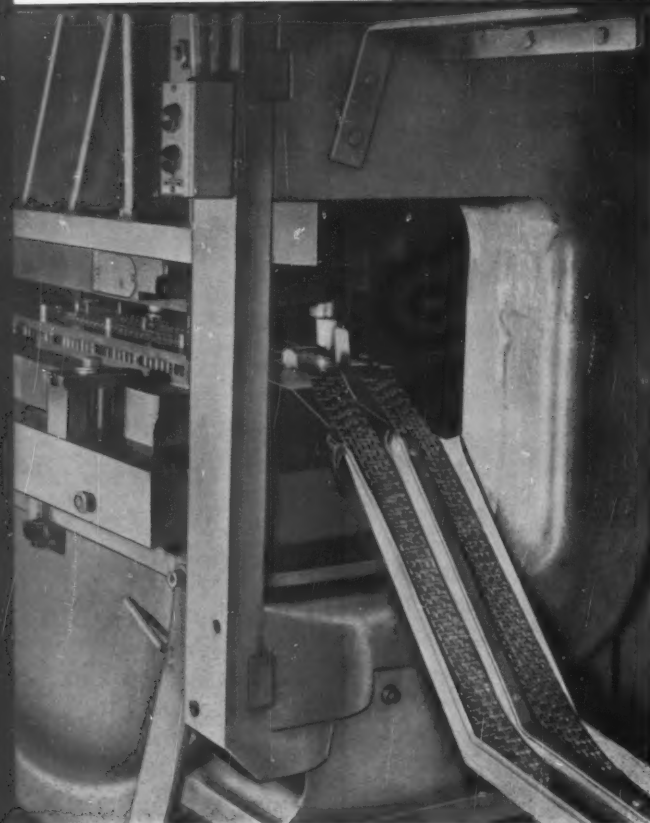
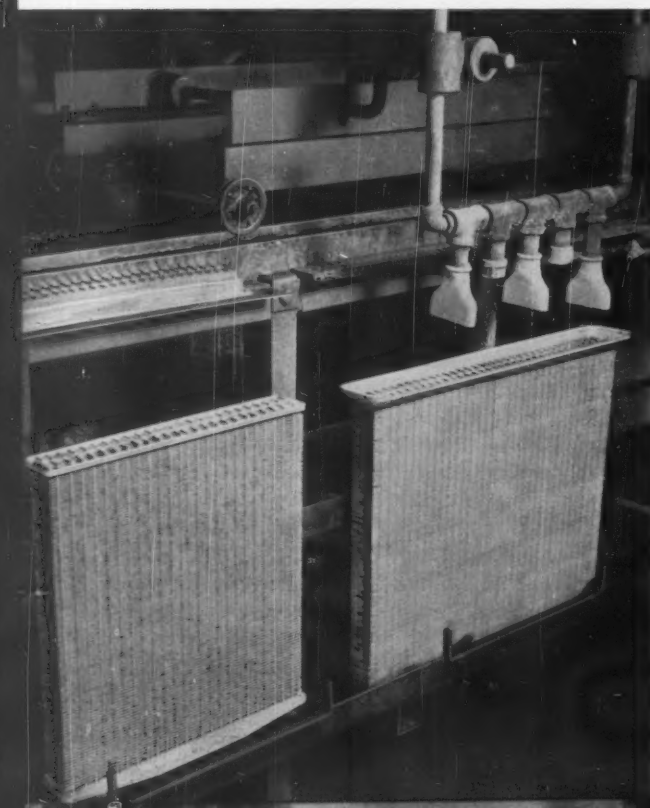


Fig. 1. Radiator fins are stamped from copper or aluminum strip stock on this 60-ton press which is equipped with a double die.

Fig. 2. (Below) Automatic soldering machine on which gas torches are traversed past work to melt solder and join radiator header to tubes.



joined to the headers on other automatic soldering machines, Fig. 3. Here, sealing is effected by automatically feeding 1/8-inch diameter wire solder to the seam and melting it with torches. As seen in the illustration, the torches and solder-feeding mechanism move from left to right. Two gas-flame torches preheat the tanks and headers, while a third melts the solder. The wire solder is fed through the tube seen extending down at an angle from the upper right. The flared nozzle in the center is for compressed air to cool the soldered surfaces. Four core assemblies are completed simultaneously on each machine, and two machines are employed—one for the top tank and the other for the bottom.

Inlet and outlet fittings, overflow tubes, and core sides are attached manually. Completed cores are placed on a conveyor, washed by immersing in three successive baths, dried, tested, and painted. Painting is performed automatically in electrostatic spray booths. An electrostatic field of 100,000 volts is directed toward the radiators from pronged electrodes. The radiators are grounded through their supporting hooks and through the conveyor. Electrically charged, atomized paint particles are attracted to the radiators and applied in thin, smooth coats—even around curved surfaces. A separate booth is used to spray one side of each radiator, and two spray gun stations are located in each booth. Infra-red heaters are employed to dry the radiators.

Wide Variety of Clutches Produced

In an average month, Long produces about 150 different combinations and models of clutches. While only 20 standard model clutches are available, nearly 200 types of driven members and approximately 90 different cover-plate assemblies are produced. Standard clutches of the semi-centrifugal, single-plate, dry type are made from 9 through 13 inches in diameter. Heavy-duty clutches of single- and multi-plate types vary from 11 to 17 inches in diameter. Automatic-transmission clutch plates, made by bonding semimetallic, cork, organic, or other frictional material to a steel core, are tailored to fit the transmissions in which they are to be used.

Clutch pressure-plates require facing, milling, and drilling operations, and, in some cases, grinding. A special three-column, triple-head milling machine, Fig. 4, made by the Michigan Drill Head Co., is used to mill slots in the three lugs on each pressure-plate. The machine has three

Fig. 3. In joining top radiator tank to header, wire solder is fed through angular tube at upper right and melted by torches.

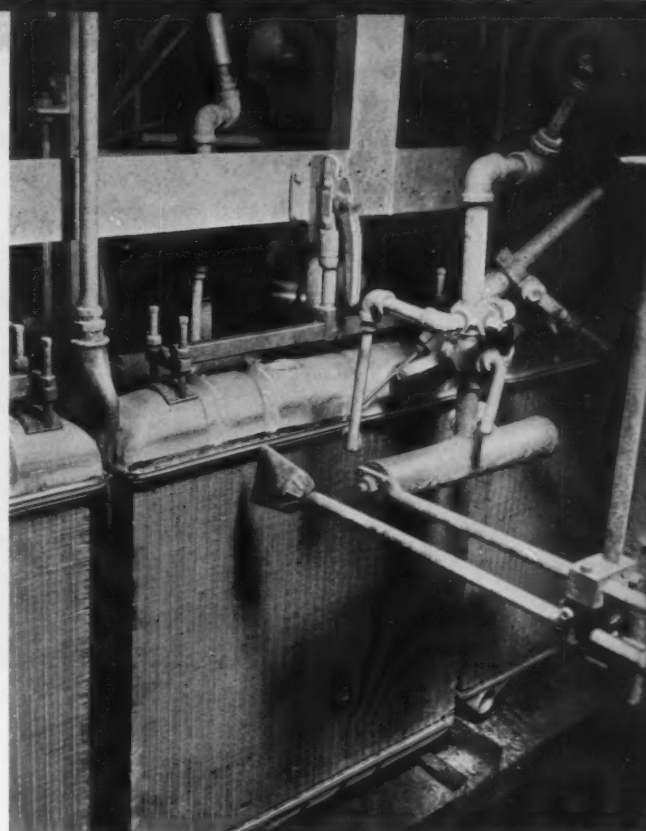
hydraulically operated, vertical feeding units mounted on a single base. Also, three hydraulic indexing tables, each having three work stations, are provided. A milling cutter is mounted on each vertical spindle to plunge-mill one slot every time the table is automatically indexed. Power clamping of the work-pieces is performed hydraulically.

All that is required of the one operator is to load and unload clutch pressure-plates. The machine cycle is synchronized so that two parts are being machined while another is being loaded or unloaded. In this way, a production of 300 plates per hour is possible. The cutters are rotated at 123 R.P.M., providing a cutting speed of 225 feet per minute, while the feed per tooth per revolution is 0.003 inch. Various size clutch pressure-plates can be handled with only minor modifications in the machine setup.

Production of Stamped and Welded Torque Converters

One of the pioneering developments by Long was the design and production of successful, stamped-and-welded construction torque converters for automatic transmissions. The torque converters are fabricated from accurately formed stampings, precision machined to tolerances of plus or minus 0.0005 inch, and joined by continuous automatic welding operations. By changing the interior components of the converters they are adaptable to a wide range of engine torques.

Stampings are made on twenty-two assorted



hydraulic and mechanical presses, as well as dieing machines, having capacities ranging from 35 to 1000 tons. The thickness of steel used varies from 0.0275 to 0.281 inch, and the average consumption is 500 tons per month. Aluminum-alloy bearings for the torque converters are turned, faced, chamfered, and bored on the Ex-Cell-O precision boring machine seen in Fig. 5. This double-end, four-spindle machine is equipped with a total of twenty-eight carbide tools. A production of 100 bearings per hour is obtained, and

Fig. 4. Slots are milled in the lugs on clutch pressure-plates by means of this special triple-head milling machine at the rate of 300 an hour.



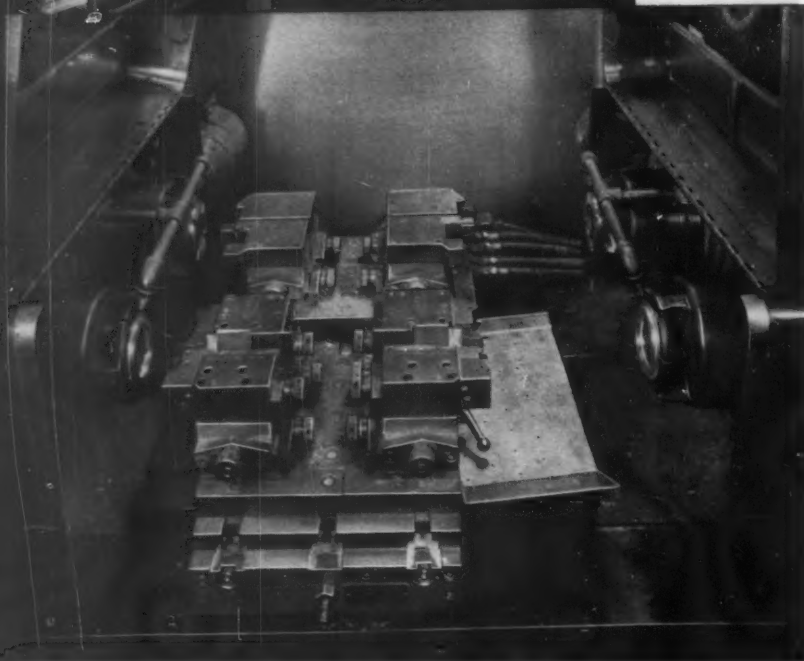


Fig. 5. Double-end, four-spindle boring machine has twenty-eight carbide tools for turning, facing, chamfering, and boring torque-converter bearings.

the bores and outside diameters are maintained within plus or minus 0.0002 inch of the specified sizes.

Stator assemblies consist of stamped vanes and machined hubs, pressed into shells. The assemblies are copper brazed and machined, and the inner face of the hub is induction hardened. Hardening of this and other torque-converter parts is done on the Reeve three-station, 25-K.W., high-frequency induction-heating unit seen in Fig. 6. Electronic tubes are employed to obtain the frequency of 450,000 cycles per second, and voltage regulators are provided to maintain the frequency uniform. City water is used to quench the heated parts. The water is recirculated, and its temperature is maintained constant by adding water when required.

In the illustration, the inner face of the stator hub assembly is shown being quenched at the station on the left. An outer race hub for the stator is hardened at the center station, and the drive hub of the impeller, at the right-hand station. Work-pieces at the left- and right-hand stations are rotated during induction heating. The part at the center is heated while stationary. All three parts are hardened to 60 Rockwell C. The inner face of the stator hub is heated for eight seconds and quenched for twelve seconds to attain a hardened case from 0.060 to 0.080 inch deep. A case from 0.080 to 0.120 inch deep is produced on the stator outer race hub by heating for twenty-eight seconds and quenching for twelve seconds. Since the impeller drive hub is only 0.120 inch thick, a quick heating cycle is neces-



Fig. 6. This three-station, 450,000-cycle, induction-heating unit is used for hardening various torque-converter parts. The heated parts are then quenched with water.

Fig. 7. Bosses, washers, studs, brackets, and clips are attached to the front covers (flywheels) of converters on these resistance welding machines.



sary. By heating for only two and one-half seconds, a case from 0.050 to 0.070 inch deep is obtained.

Turbine assembly begins by placing stamped vanes and a machined core-ring in a pressed shell. The vane tabs are folded over, and the hub is riveted to the sub-assembly on a Bliss 70-ton press. Runout is checked on a Sundstrand indicator stand, and the sub-assemblies are dynamically balanced.

Impellers are assembled in much the same way, except that a hub is arc-welded and a washer resistance welded to each impeller shell. The front cover, or flywheel, of the converter is a heavy steel stamping that covers the outside of the turbine, and is fastened to the crankshaft of the car at assembly. Mounting bosses, pilot and thrust washers, studs, internal brackets, and clips are attached to the front covers on special Multi-Hydromatic resistance welding machines shown in Fig. 7. From 25 to 30 K.V.A. are required per spot-weld, and the welds are made in series to reduce the total current requirements.

Torque-converter halves are joined together by submerged-arc welding, as seen in Fig. 8 and in the heading illustration. This machine is equipped with a Lincolnweld head having controls, wire drive rolls, and flux supply unit. Mild steel wire, 1/8 inch in diameter, and granular flux are automatically fed to the weld area, as the work is rotated to give a surface speed of 40 inches per minute. This relatively slow welding speed is employed to minimize the chance of leaking from the assemblies. Welding is performed at 425 amperes and 24 volts. Flux is scraped from the initial weld area to permit a slight overlap.

Fig. 8. Close-up view of submerged-arc welding machine seen in heading illustration. Welding is performed at 425 amperes and 24 volts.



AUTOMATED CONTOUR-TURNING SPURS DYNAFLOW PRODUCTION

Contour-turning lathes equipped with automatic loading and unloading devices have boosted the production rate for Dynaflo transmission input shafts and converter hubs by reducing setup time, permitting higher cutting speeds, and minimizing the amount of gaging required. In some cases, the need for rough-grinding has been eliminated by the finishes obtained and the close tolerances held in contour-turning.

By CHARLES H. WICK

A MAJOR exception to the trend toward multiple tooling and increased horsepower for automotive production machines is the extensive use of contour-turning lathes at the Buick Motor Division of General Motors Corporation, Flint, Mich. Such machines, equipped with automatic loading and unloading devices, have boosted the output of shafts and converter hubs for the Dynaflo transmissions.

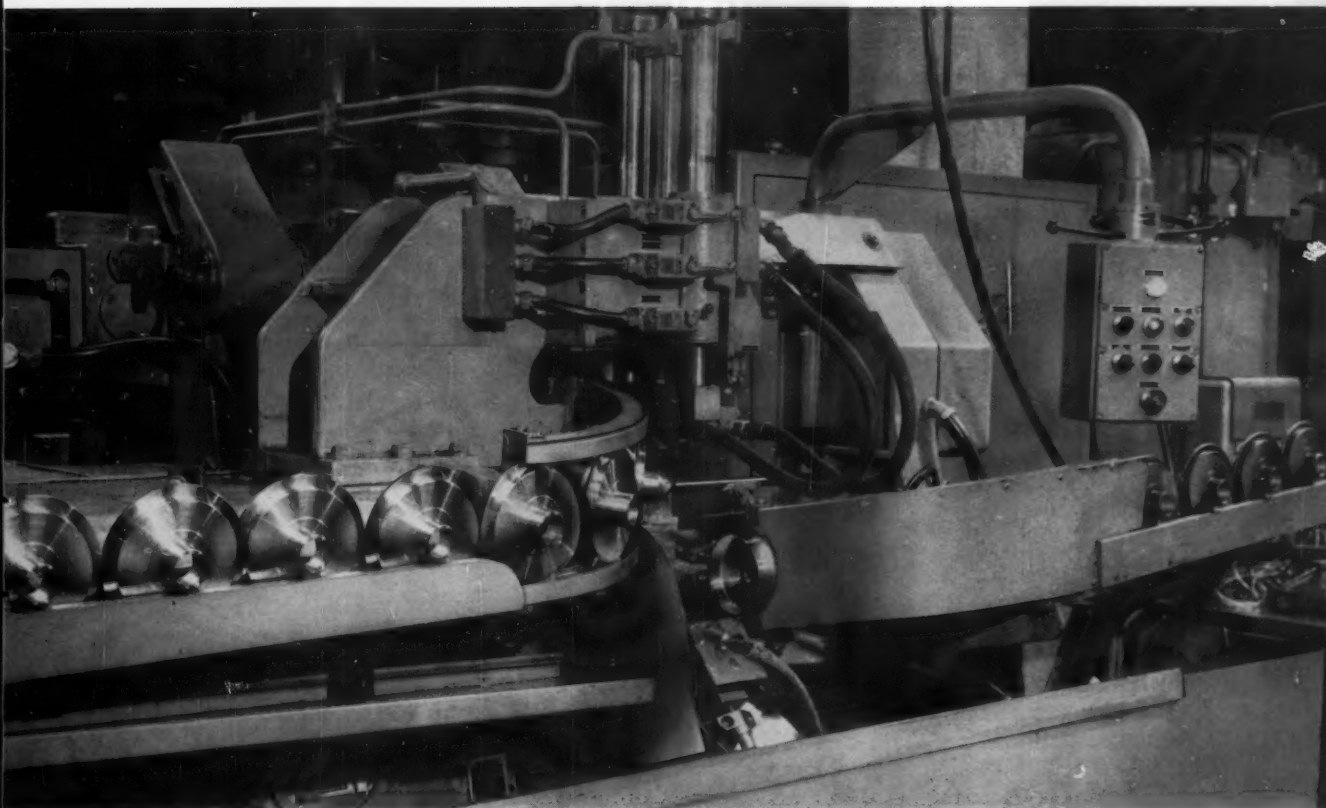
In contour-turning, the irregular shape of a template is duplicated on the work-piece by controlling the cutting tools through the action of a follower that moves over the surface of the template. Since only the template and one or a few single-point cutting tools are employed, setup and down time for tool changes are held to a minimum—usually less than one hour. Expensive form tools are not required. The machines are extremely versatile and can easily accommodate modifications in product design, or make replacement parts, with only limited changes in the tooling.

With only one or a few single-point tools cutting, pressure on the work-piece is minimized and there is practically no distortion of long slender shafts or tubular parts. Relatively high cutting speeds and feeds can be used, thus increasing the production rates. Also, the smooth surface finishes created and close tolerances maintained have, in some cases, eliminated the need for sub-

sequent rough-grinding. The required accuracy is consistently duplicated, and it is only necessary to occasionally measure one diameter on a work-piece to determine tool wear and insure that the setup has remained constant.

Converter input shafts for Dynaflo transmissions are profile-turned on Pilot automatic copying lathes such as the one seen in Fig. 1. These lathes, designed and sold by H. E. B. Machine Tools, Inc., were built in this country by Industrial Metal Products Corporation, Lansing, Mich. Each lathe has a triangular cross-section, one-piece casting that forms an inclined bed to insure good chip clearance and a rigid base. The cross-slide is mounted at 90 degrees to the bed. Longitudinal carriage travel, live center tailstock, copying mechanism, and infeed device are all hydraulically operated.

A unique feature of the Pilot lathe is that the feed per spindle revolution remains constant at the pre-set value, regardless of changes in spindle speed or the resistance encountered by the cutting tools. This is accomplished by having a pilot screw, driven by the lathe spindle, in mesh with a locked pinion attached to the lathe carriage. The screw is free to move axially, but one end is in contact with a valve that controls the amount of oil entering a hydraulic cylinder which, in turn, controls longitudinal movement of the carriage. If the feed varies, the pinion will drag or push the



screw axially, thus increasing or decreasing the valve opening.

The hydraulic copying device, which is an integral part of the lathe, is operated by a piston on the cross-slide. Pressure is varied on both sides of this piston (the two sides differing in area) by oil metered from a cylinder through a tracer-actuated valve. Any change in valve opening, caused by movement of the tracer in contact with the template, causes instantaneous tool response. Template and work-piece angles up to approximately 60 degrees included angle are handled by the hydraulic copying device, while facing of shoulders forming an angle from 60 to 90 degrees is accomplished by means of limit switches and electromagnets. As the tracer contacts a sharp shoulder on the template, it is deflected and closes a switch, thus causing a magnet at the end of the feed shaft to be de-energized. This declutches the shaft, and a second magnet is energized to close the hydraulic valve in the copying device. The tracer and tool are then automatically moved forward.

Converter input shafts are made from SAE 1041 steel tubing approximately 1 3/8 inches in diameter and having a bore of 7/8 inch. Tubes are cut off into 11 1/4-inch lengths and internally broached prior to profile-turning. Then the parts are manually loaded into a magazine mounted directly above the tooling area on the copying

lathe, as shown. Since the operator need only keep the magazine filled and make periodic tool changes, he can easily attend three machines.

The automatic loading device, Fig. 2, releases one shaft at a time. The shaft is clamped between an expanding arbor in the headstock spindle and a spring collet on the tailstock live center—locating from the previously broached bore. A carbide tool mounted on the rear block is hydraulically fed in to face the shaft to the required length of 11.210 inches. The diamond-shaped, single-point carbide tool on the front tool-block—controlled by the template and hydraulic copying device—contour-turns surfaces on the shaft to the required five different diameters and four lengths in one pass.

Maximum depth of cut is 0.100 inch. The work is rotated at 970 R.P.M., providing a cutting speed of 320 surface feet per minute, and the tool is fed at the rate of 0.018 inch per revolution. Completed shafts are automatically ejected as the arbor and collet are retracted. The shafts fall onto rails (seen at the lower right) secured to the carriage, and roll onto a chain conveyor for transfer to the next operation. When a part has been finished, the tools return to their starting positions and the spindle is braked to a stop—ready to repeat the automatic cycle. Coolant is directed onto the work-pieces from nozzles built into the tool-blocks, and a splash guard is mounted on rollers

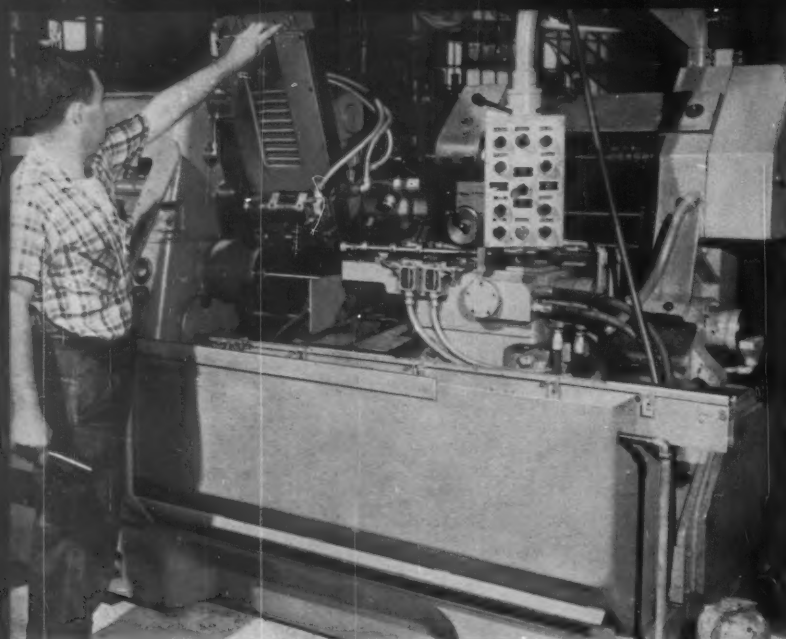


Fig. 1. Hydraulic copying lathe, equipped with magazine loading and automatic unloading, for profile-turning of converter input shafts of Dynaflo transmission.

at the front of the machine so that it can be easily pushed aside to facilitate tool changes.

Actual cutting time per shaft is only 0.66 minute. Added to a 0.23-minute loading time, this gives a complete cycle time of 0.89 minute—or a production of forty-seven shafts per hour at 70 per cent efficiency. A tolerance of plus or minus 0.001 inch is maintained on the various diameters, and plus or minus 0.002 inch on the different lengths of the thin-wall tubular parts. This necessitates only finish-grinding of the critical surfaces and eliminates the need for rough-grinding.

Main input shafts for the automatic transmission units are approximately 14 7/8 inches long and 1 inch in diameter, and made from SAE 5145 steel. Since these shafts must transmit the full torque of the engine, their peripheries are finished all over and made free from tool marks. Accurate contour-turning is essential to successful and economical finish-grinding. Previously, turning was done with gang tooling on multiple-spindle machines, and the bumps left where adjacent tools cut the parts made precision grinding difficult. Now, the shafts are contour-turned on

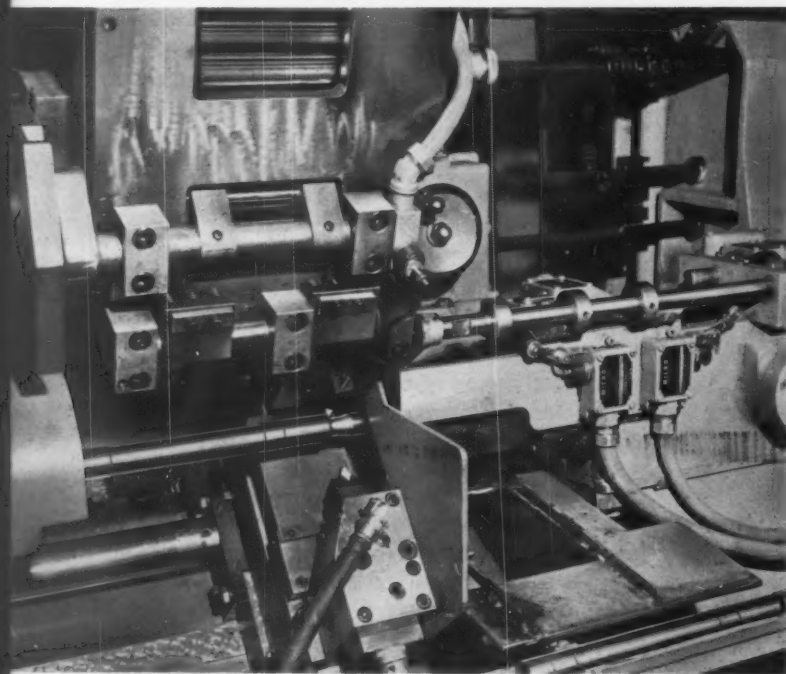
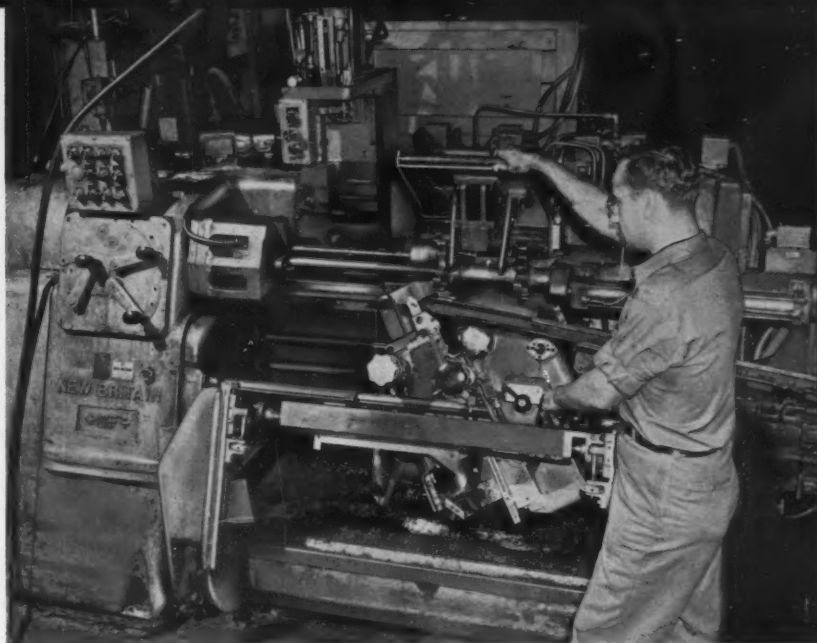


Fig. 2. Close-up view of the lathe seen in Fig. 1. Carbide tool on rear block faces the shafts to length, while tool in front, controlled by a template, performs a profile-turning operation.

Fig. 3. Main input shafts for automatic transmissions, 14 7/8 inches long, are contour-turned in a 0.8-minute cycle (including loading and unloading) on this lathe.



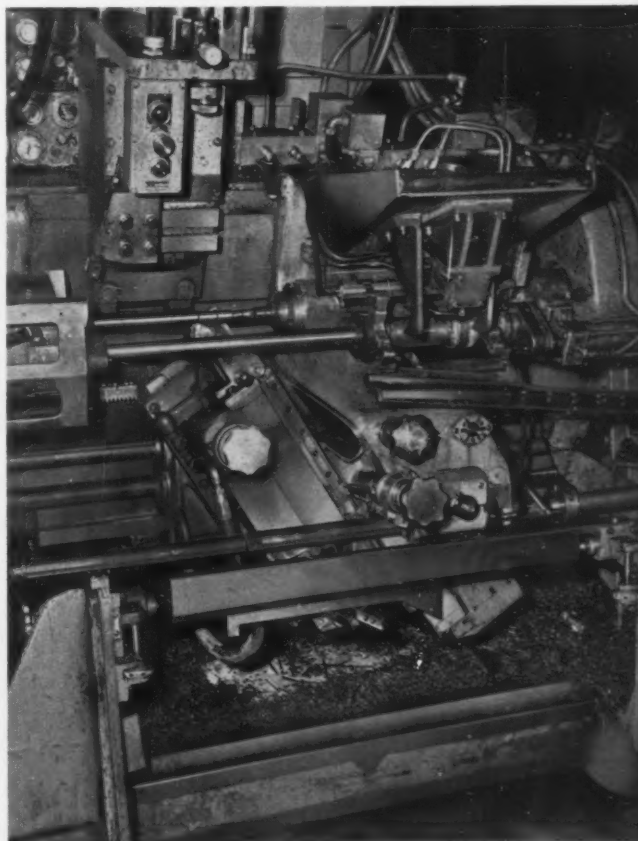
New Britain + GF + copying lathes, such as the one seen in Fig. 3. Three of these lathes, attended by only one man, have the same output as six of the machines used formerly.

The hydraulic copying attachment on these lathes is in a vertical plane with the center line of the work, so that chips fall into a pan at the bottom of the machines. Automatic control of the contouring tool results from the difference in pressure between a constant-pressure chamber and an operational chamber. Movement of the tracer along a flat template, conveniently mounted at the front and near the bottom of the lathe as shown in Fig. 4, varies the size of an aperture that results in a change in the pressure in the operation chamber. As this pressure increases, due to a rise in the template and a narrowing of the control aperture, the tool-slide is automatically moved downward. Conversely, when the follower contacts a depression, the pressure is decreased, and the slide raised. When the tracer is not in contact with the template, a spring keeps a control valve open, the oil returns to a reservoir, and there is no pressure in the operation chamber.

A monorail conveyor carries the input shafts to the three copying lathes, which are arranged in a triangular layout to facilitate manual loading of the magazine provided on each lathe. A pivoting arm, Fig. 5, having gripping clips at two work-holding stations, automatically picks up a bar from the magazine and transfers it to the loading position. Here, the work-piece is clamped by a Skinner three-jaw chuck, mounted on the headstock spindle, and a tailstock center.

During the automatic machining cycle, a diamond-shaped, single-point carbide tool on the

Fig. 4. Movement of tracer along flat template, seen at the front and near the bottom of the lathe, automatically controls motion of the profiling tool through a hydraulic device.



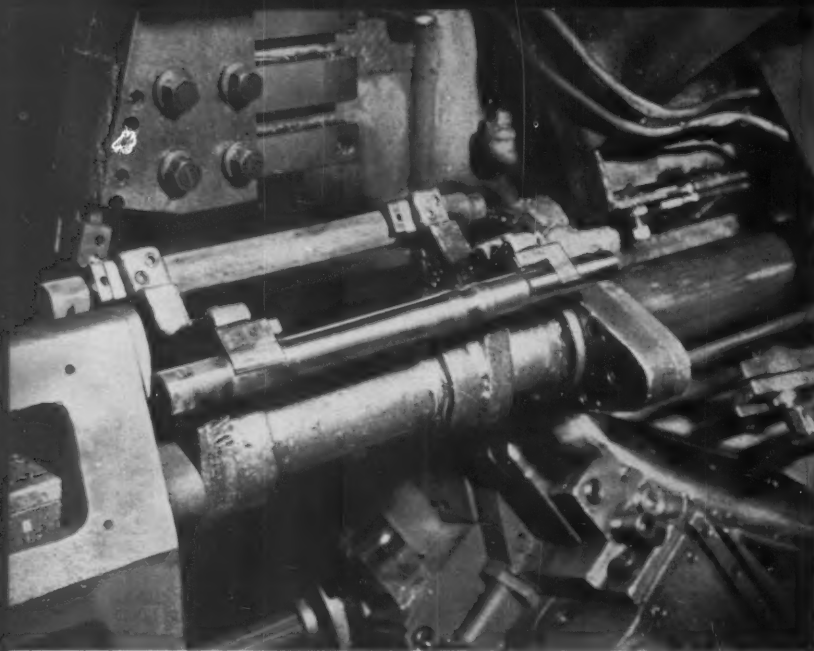
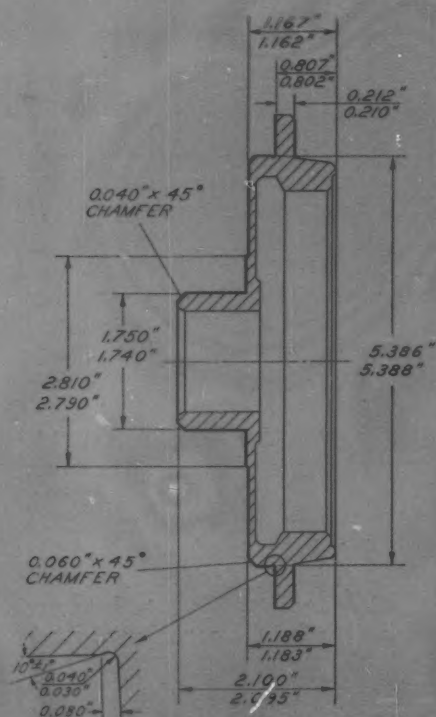


Fig. 5. Pivoting arm has work-gripping clips at two stations so that it can automatically unload a contour-turned input shaft while loading a new piece of bar stock.

Fig. 6. Cross-sectional drawing of a converter hub for the first turbine of a Dynaflo transmission shows the form produced and the tolerances maintained in the profiling operation.



lower, tracer-controlled tool-block profile-turns six peripheral surfaces—including two concave surfaces—to the required diameters. Simultaneously, a triangular-shaped, single-point carbide tool, mounted on the air-operated infeed, upper tool-block, faces a shoulder on the main input shaft. Completed shafts are picked up by clips at the second station on the pivoting arm, swung out of the loading position (while a new bar is being loaded), and transferred to a chute leading to the next operation.

The work is rotated at 1210 R.P.M., providing a cutting speed of 350 surface feet per minute based on the surface turned to a diameter of 1.093 inches, and the profiling tool is fed at the rate of 0.022 inch per revolution. Actual cutting time is only 0.55 minute, while loading of the work and positioning of the tool require 0.15 minute. Unloading, retraction of the tool, and return of the carriage take another 0.1 minute—resulting in a production of about fifty-two shafts per hour from each machine at 70 per cent efficiency.

Another H. E. B. Pilot hydraulic copying lathe equipped with automatic loading and unloading devices is seen in the heading illustration. This lathe is employed to completely semifinish-machine the hub end of first turbine converter hubs forged from SAE 1052 steel. The sectional drawing of a converter hub in Fig. 6 shows the machined surfaces in heavy outline and the tolerances maintained in this operation. Tolerance on the 5.387-inch diameter pilot surface is only plus or minus 0.001 inch. Previously, this job was done on a multiple-spindle machine, requiring twenty-two cutting tools and considerable setup and gaging time. Now, only three tools are necessary—and they can be changed in two minutes.

Converter hubs to be machined roll down a track seen in the foreground and at the left in Fig. 7. Tooling on the piston of a hydraulic cylinder, mounted in the tailstock position on the lathe, picks up one of the forgings and pushes it onto an expanding arbor secured to the lathe spindle. The work-piece is located from its previously machined bore. Movement of the diamond-shaped, single-point carbide tool on the front block, shown at the bottom in Fig. 8, is controlled hydraulically from a circular template to face, turn, and chamfer the hub. The template can be seen at the upper right in Fig. 7.

The lathe is equipped with a variable-speed, direct-current motor drive that automatically decreases the spindle speed as the cutting tool is progressively moved to larger diameters on the work-piece. This maintains a constant surface speed and insures a uniform surface finish with maximum efficiency due to the patented H.E.B. hydraulic feed which maintains a constant feed per revolution. Two diamond-shaped, single-point carbide tools, mounted on the rear tool-block, are hydraulically fed toward the work to face both sides of the large-diameter flange. At the completion of the cuts, the tools retract, and the hub is lifted from the arbor by means of hydraulic cylinders. The parts are dropped onto a discharge track, seen at the left in the heading illustration, which leads to the next operation. The gross production from this hydraulic copying lathe is fifty-three converter hubs per hour.

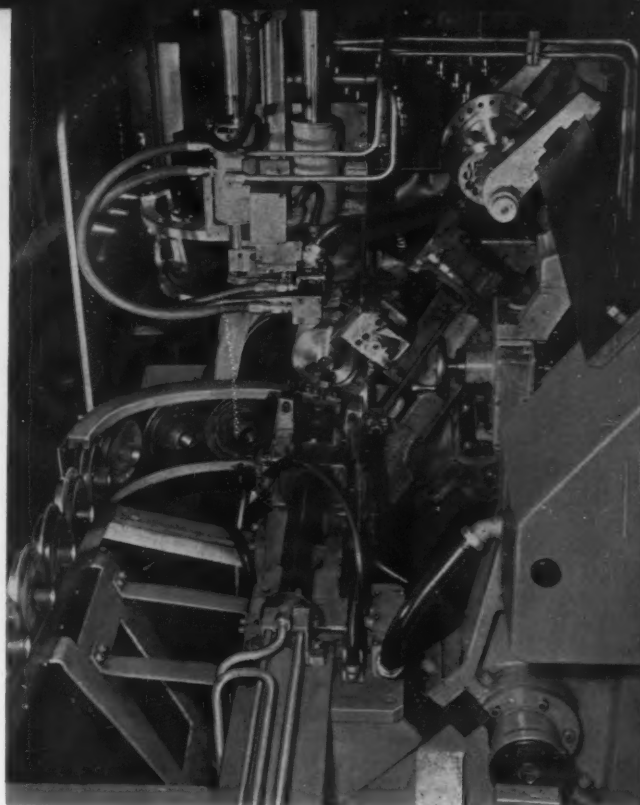
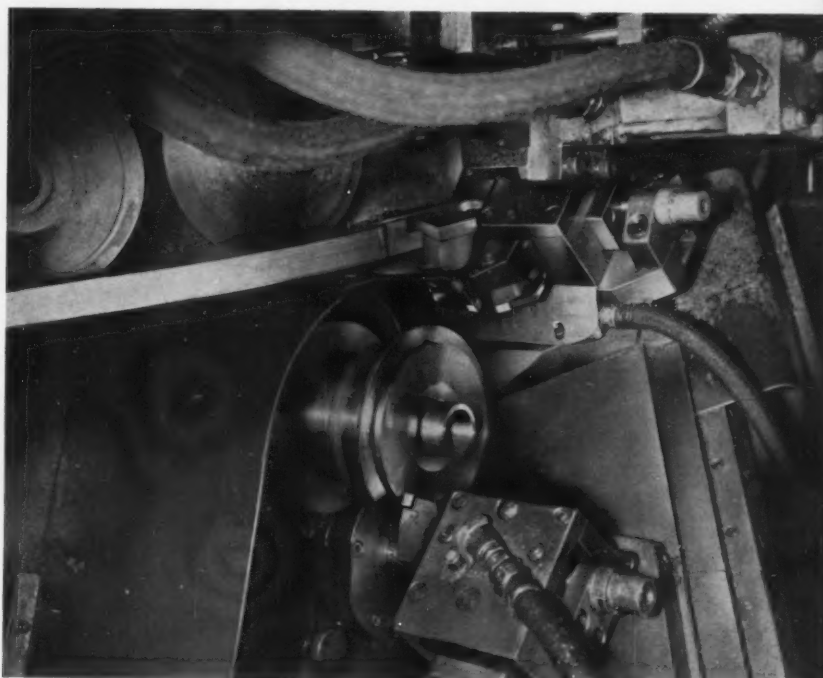


Fig. 7. Forged converter hubs roll down the track seen at lower left and are picked up and loaded by tooling on hydraulic cylinder mounted in the tailstock position on the lathe.

Fig. 8. Close-up view of the tooling area on the hydraulic copying lathe seen in the heading illustration. Two rear tools face both sides of flange, and front tool profiles the hub end.



TRANSFER PRESS

Completes 1000 Air Cleaner Shells per Hour

By WALTER N. HANNA

Assistant Superintendent, Production Engineering
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OUTPUT of air cleaners has been boosted, manual materials handling has been eliminated, and floor space requirements have been reduced at the AC Spark Plug Division plant in Flint, Mich., through the installation of three 900-ton transfer presses. These "Transmat" presses, made by the Verson Allsteel Press Co., completely form air cleaner oil bases from coil stock in one automatic cycle consisting of eight consecutive operations. Each press is capable of producing 1000 bases or shells per hour.

The presses, one of which is seen in the heading illustration, have eccentric type drives, pneumatic clutch and brake units, and full electric controls. Each press has ten stations and two separately adjustable slides. Only eight of the ten stations are operating stations for producing the air cleaner oil bases, the two idle stations transport the parts through the middle column of the press. Changing the dies in the press to make similar parts can be done in eight hours or less. Also, the dies can be used singly on individual presses if necessary.

A major improvement over transfer presses previously installed at AC is that the blanking die is located in an individual yet integral press mounted at the right-hand end of the conventional transfer press. Work-pieces are transferred from station to station by mechanical fingers synchronized with the press action. A part is completed with each stroke of the press ram. Since the cycle is completely automatic, only one oper-

ator is needed to keep the press supplied with stock and to periodically check the operation and parts produced. Maintenance requirements are much less than if the parts were produced by successive operations on individual presses.

Oil bases are made from SAE 1008 or 1010 steel coated with an alloy of 20 per cent tin and 80 per cent lead (terneplate), electrolytically pure tin (tin plate), or zinc (galvanized plate). Air cleaner bases for various models of automobiles require material 0.018, 0.025, or 0.031 inch thick, and from 18 1/2 to 20 inches wide. Coils of the cold-rolled, deep-drawing quality, coated steel are fed from a Littell reel, Fig. 1, through straightening rolls and into the die by a Littell roll feed featuring floor-level adjustment of the feed length with a micro adjustment that is operable with the press running. The feed operates in 130 degrees of the cycle. Drawing compound is applied to the material prior to the blanking and drawing operations.

At the first station, Fig. 2, blanks are stamped from the coil stock and drawn into a cup shape having a depth of approximately 4 inches and a diameter of about 12 1/2 inches. The tooling is mounted in a Danly precision die set having no shank. Cast-to-shape, Allegheny Ludlum FCC, air-hardening tool steel is used for the blanking die, pressure ring, form die, and punch at this station, as well as for forming, clamping, and cutting members in subsequent dies. This steel has a high carbon (1.5 per cent), high chromium (12



per cent) analysis. The blanking die is provided with three point shear, $3/64$ inch deep.

From this point on, the drawn parts are automatically carried from station to station by a mechanically actuated transfer mechanism. The mechanism consists of two channel-shaped aluminum members which extend horizontally along the front and back of the press. Gripping fingers that hold the work-pieces while they are being transferred are bolted to racks working in and out through gear-boxes which are fastened to the aluminum members at 20-inch intervals, which is the distance the parts are indexed each cycle.

During the automatic transfer cycle, the aluminum members move from right to left. At the extreme right the fingers move in, and at the extreme left the fingers move out, thus the fingers describe a rectangular path in a horizontal plane: first, advancing toward the center line of the press where the fingers grip the parts; second,

moving sideways (to the left) to advance each oil base one station; third, retracting outward to release the parts in the required locations for the next operation; and fourth, again sideways (this time to the right) to return the transfer members to their starting positions, ready for the next cycle. All movements are synchronized with the motion of the press slide.

The second and third stations transfer the part through the middle column, as previously mentioned. At the fourth station, the air cleaner oil bases are redrawn to depress the top center area to a depth of about $1\ 3/8$ inches. This shape as well as the successive forms produced on the transfer press are illustrated by the cross-sectional drawings in Fig. 4. The redrawing punch has been specially developed to minimize the formation of wrinkles in the parts.

In striking the drawn bases at the fifth station, the depth of the depression in the top of the part

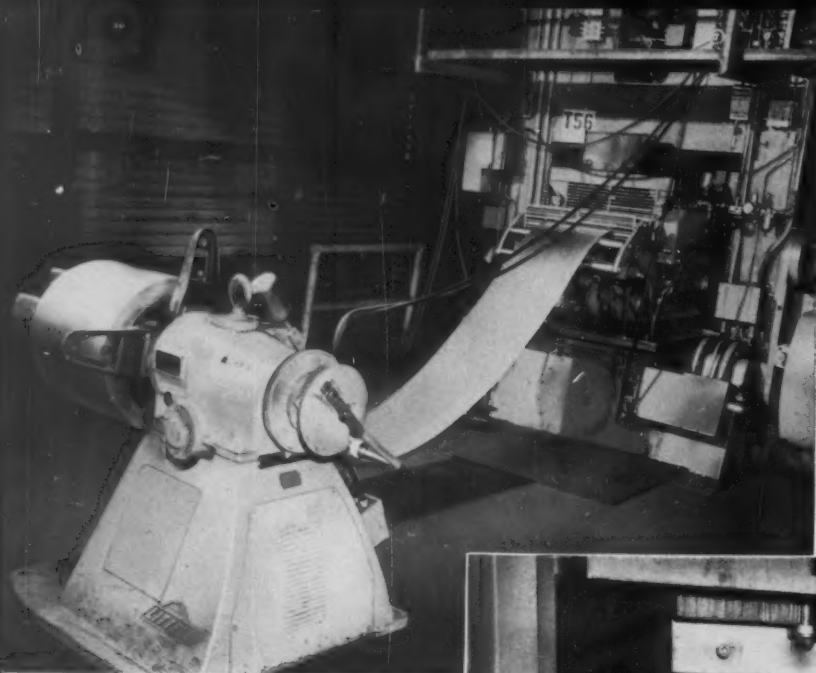


Fig. 1. (Left) Coated steel stock, supplied from coil seen at the left, is fed into transfer press (heading illustration) by a roll feed.

Fig. 2. (Right) Close-up view of first station on transfer press where oil base blanks for air cleaners are stamped from coil stock and drawn to a depth of 4 inches.



Fig. 3. (Left) View along back of transfer press shows the continuous belt conveyor (lower right) for removing pierced discs from bed of press below the sixth station.

Fig. 4. Successive shapes (top to bottom) produced on the 900-ton transfer press seen in the heading illustration.

is increased to approximately 1 7/8 inches, and the required contour is formed on their peripheries. When the oil base has been transferred to Station 6, a disc 5 1/8 inches in diameter is pierced from the center. At the next station, the inner pierced edge of the air cleaner oil base is extruded downward. The flange drawn on the lower edge of the part is trimmed to a diameter of 13 1/8 inches at the eighth station. After again indexing, the words "Oil Level" are stamped with a cam die, on the side of the part, in letters 0.050 inch wide, 1/4 inch high, and 0.015 inch deep. Tooling at the last station wipes the external flange downward to form a straight skirt on the part.

The discs pierced from the oil bases at the sixth station are lifted from the press bed by a continuous belt conveyor and deposited in a truck. Also, half of the stock trimmed from the flange slides down a chute into the truck seen in back of the conveyor in Fig. 3. The other half of the flange trim slides down another chute at the front of the press, as shown at the left in the heading illustration. Scrap produced from the coil stock at the first blanking station is also divided, half of it sliding down a chute at the back of the press (Fig. 2), and the other half, at the front.

When the air cleaner oil bases leave the transfer press, they are automatically inverted and fed into the Bliss curling press seen in Fig. 5. Here, the parts are gripped (one at a time), elevated, and held stationary while eight rotating, grooved curling rolls spin over the edge to form a thickened, rigid rim. Completed oil bases are conveyed through a washer and carried, by means of a monorail, to the assembly area.

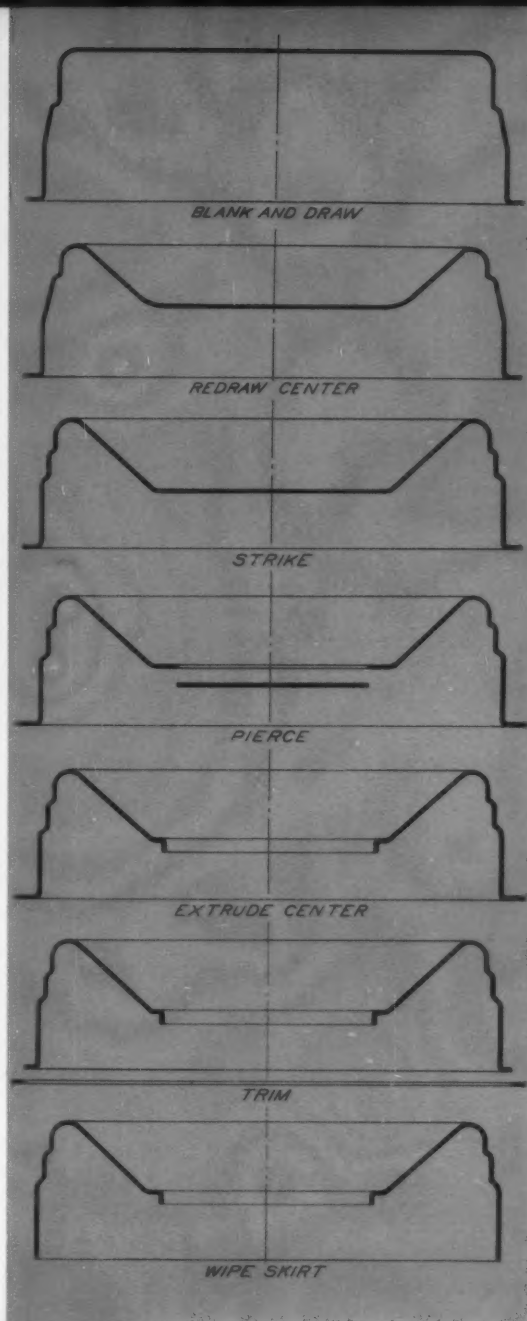


Fig. 5. (Left) Rotating grooved rolls on this curling press spin over the edge of air cleaner oil base to form a rigid rim. The completed bases are conveyed through a washer.

POWER-



SAFETY power-steering systems made by the Saginaw Steering Gear Division of General Motors Corporation consist essentially of a steering shaft, ball bearing worm and nut, power piston and rack, and hydraulic cylinder—all arranged compactly with in-line construction. A hydraulic control valve is mounted on top of the housing. In the all-important steering worm and nut components, recirculating steel balls act as a "rolling thread."

Ball grooves in the steering worm and nut have a Gothic-arch shaped cross-section to control the contact angles between balls and grooves within close limits of the 45-degree optimum. This design increases ball life, controls lash, and minimizes possible contamination as a ball hindrance factor. Another design feature is the provision of a double taper (0.003 inch per inch) extending toward both ends of the worm from a "plateau" at the center. This provides zero backlash when the car wheels are pointed straight ahead, thus reducing wind-sway and weaving. Also, the predetermined looseness at the ends of the worm fa-

cilitates return of the car to a straight-ahead position after a turn has been made.

Steering worms, approximately 8 3/4 inches long and with a maximum diameter of 1 1/4 inches, are made from SAE 5120 steel. These worms were formerly turned from bar stock on multiple-spindle machines, and about two-thirds the weight of each bar was produced as chips. Now, the parts are cold-extruded with carbide dies to within 0.045 inch of the required dimensions in three passes. This represents a stock saving of approximately 50 per cent over the previous method of manufacture. Scale from the cold-extrusion dies is removed from the worms by shot-blasting.

The worms are milled to length and centered simultaneously on a Davis & Thompson continuous type rotary machine equipped with an automatic unloading unit. Centers in both ends of each shaft are coined with carbide tools, and the heat code is stamped on one end on a special Saginaw-built, air-operated machine. Turning, chamfering, and under-cutting of the worms are

STEERING UNITS REQUIRE PRECISION COMPONENTS

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Ball bearing worms and nuts for automotive power-steering systems are sorted into classifications varying from each other by only 0.0002 inch on pitch diameter to permit selective fitting at final assembly. Some of the techniques employed to mass produce these precise components are described and illustrated in this article.

done on two Seneca Falls Lo-Swing lathes, locating the work from the previously coined centers and removing about 0.030 inch of stock. The surface, approximately 4 inches long, which is to be grooved to form the ball groove, is centerless ground on a Cincinnati machine, removing about 0.012 inch of stock and holding required size to within plus or minus 0.0005 inch.

An oil passage hole, 1/4 inch in diameter and 5 9/16 inches deep, is drilled axially in one end of each worm on Avey multiple-spindle machines. The work-pieces are accurately located in air-operated fixtures from the previously ground surfaces, thus making drill bushings unnecessary. Heavy-duty, fast-twist, crankshaft type drills having polished flutes are used for this operation. The drills are automatically withdrawn from the holes when the torsional loads at their points reach a pre-set amount, thus minimizing drill breakage.

A Hoern & Dilts five-station, continuous, rotary machine, seen in Fig. 1, is employed to semi-finish-turn four surfaces, as well as face, chamfer,

groove, and under-cut the worms. All five stations are tooled identically and controlled by a single set of cams, so that a work-piece is completed with each revolution of the machine. The operator need only remove a completed part and replace it with another piece as each station passes his position.

The work is held between centers, the top center at each station being hydraulically actuated, and clamped at the bottom by a diaphragm chuck. Four tools, pre-set to gages in cartridge type holders, are provided at each station. About 0.015 inch of stock is removed from each surface, leaving 0.010 inch for finish-grinding. The work-pieces are rotated at 2200 R.P.M., and the machine can complete 600 worms per hour.

Drilling of a 3/16-inch diameter cross-hole, which connects with the oil passage hole, and milling of a keyway are done on a Hartford Special machine equipped with magazine loading and automatic ejection. Thirty-six equally spaced serrations are formed in one end of each worm on a Reed thread roller. A battery of eight Hanson-

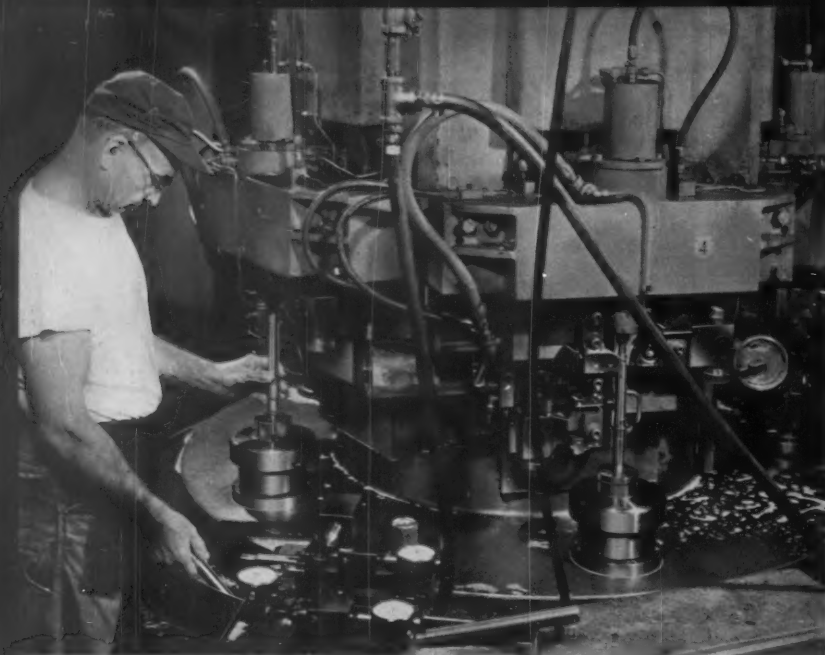


Fig. 1. Worms for power-steering units are semi-finish-turned, faced, chamfered, grooved, and undercut on this five-station rotary machine.

Whitney hobbing machines, such as the one seen in Fig. 2, cut the right-hand ball grooves to a roughing lead of $7/13$ (0.53846) inch.

Both rough- and finish-hobbing are completed in one automatic, cam-controlled cycle. After the rough pass, the hob is automatically retracted, moved toward the tailstock, and advanced the required amount for the finishing cut. During hobbing, the work-piece is backed up for support by a carbide half bushing, shown mounted on the front of the machine and behind the operator.

Hobbed worms are degreased, carburized in a

vertical position to minimize distortion, washed, and tempered to a hardness of from 60 to 62 Rockwell C. Case depth of the hardened areas is maintained at a maximum of 0.060 inch before grinding. However, the case depth at the ball grooves must be a minimum of 0.035 inch after grinding, and not more than 0.010 inch of the case can be ground off. After sand-blasting, the worms are mounted between centers and checked for straightness. If necessary, the parts are flame-straightened by passing a torch along the worm while mounted between centers. Then the worms

Fig. 2. Cam-controlled hobbing machine for rough- and finish-cutting ball grooves in one automatic cycle. The back-up bushing is seen at the lower right.



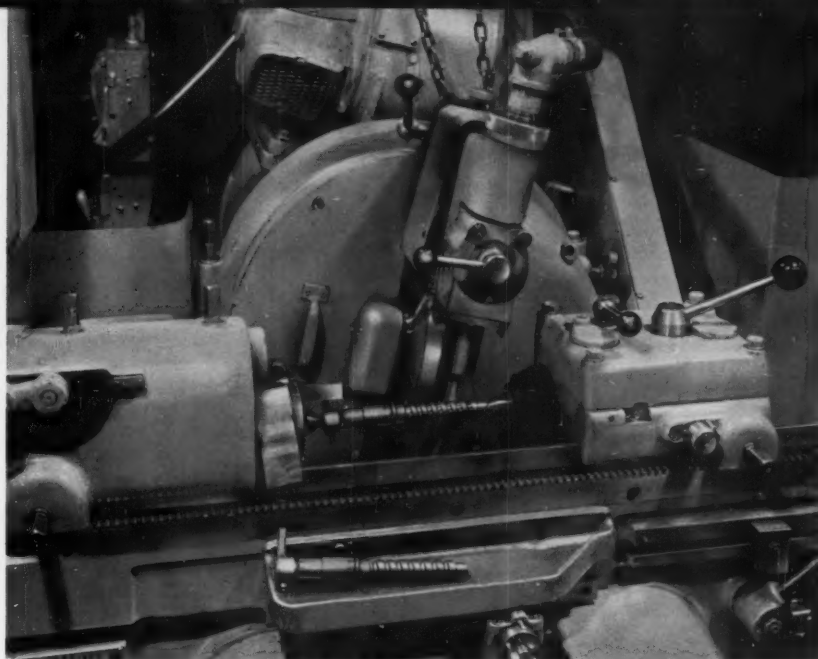


Fig. 3. Former cams are employed on this grinding machine to develop the specified taper of 0.003 inch per inch from thread center toward both ends of the worm.

are Magnaglo inspected to detect any invisible cracks or flaws.

The serrated ends are annealed to a maximum hardness of 32 Rockwell C to permit drilling at final assembly, and the hardness of the collar is reduced to 50 Rockwell C maximum. These two tempering operations are performed simultaneously and rapidly by means of a Tocco induction-heating unit equipped with a continuous rotary work-holding fixture. Centers are honed on a Saginaw-designed, double-end center lapping machine to condition worms for finish-grinding.

Ball grooves are finish-ground on Jones & Lamson external thread-grinding machines, Fig. 3, having former cams to develop the specified taper on both sides of the thread center. The finishing lead is $7/13$ (0.53846) inch, corresponding to a helix angle of 13 degrees, 37 minutes, and 14 seconds. Full thread size is maintained for 300 degrees of lead, both sides of center, and gradually blended to the specified taper. The worm is held between centers, with a driving dog and locator on the headstock end clamped to the serrations.

Thread-grinding is performed in one direction

Fig. 4. Dual-head, three-wheel grinding machine for simultaneously finishing four bearing surfaces and thrust face of collar on the steering worm.

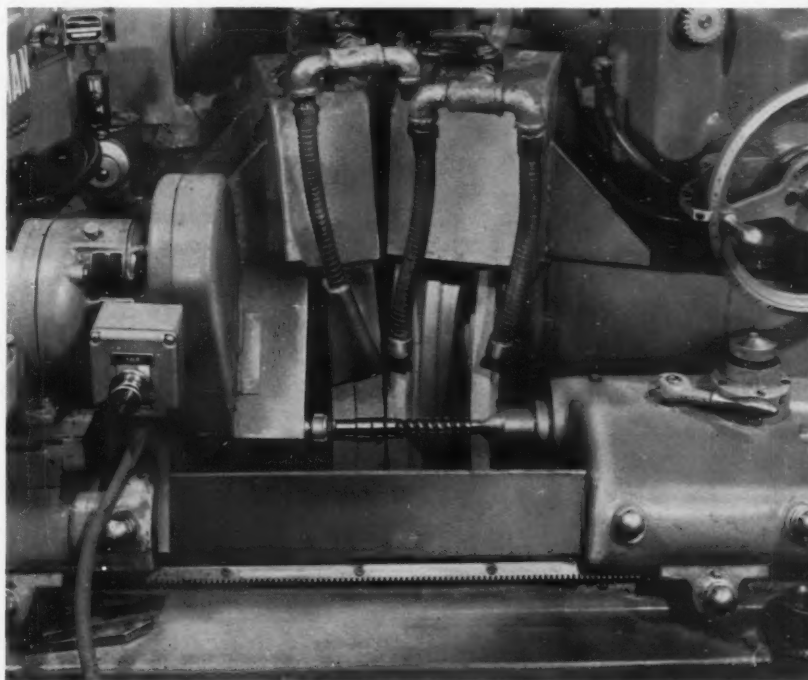




Fig. 5. Internal grooves in ball bearing nut are cut by milling cutter on this hobbing machine. Nut is clamped in a hydraulically operated fixture.

only, to avoid wind-up of the worm and loss of the lead. A total of 0.010 inch of surface stock is removed in five passes, four grinding and one sparkout. The wheel is automatically dressed by a diamond tool between the fourth and fifth passes. A special anti-friction bearing, feed-screw assembly and a Gothic-arch type, automatic radius truing device are provided to obtain the required shape on the wheel. The grinding wheel, 20 inches in diameter and 3/8 inch wide, is vitrified-bond, aluminum oxide abrasive of 80 grain size, No. 8 structure, and I hardness.

Power-steering worms are then degreased, and a non-metallic, oil-absorbent coating is applied to the ball grooves by means of a Parker Rust-Proof Lubriting treatment. Four critical bearing surfaces are finish-ground simultaneously on Van Norman dual-head, bow-gage grinding machines such as seen in Fig. 4, seventy-four parts per hour. One of the surfaces is held within plus or minus 0.0005 inch of the specified diameter, and a surface finish of 20 micro-inches maximum is produced on all surfaces. In the same operation, the thrust face of the collar is ground square with the adjoining bearing surface within 0.0005-inch total indicator reading. Also, three of the bearing surfaces are held concentric with the centers in the worm within a tolerance of 0.002-inch total indicator reading.

The name "bow-gage grinder" stems from the fact that movement of each wheel-head is actuated by a hydraulic piston that flattens a bowed flat spring. A single wheel is mounted on the left-hand head, and two wheels are on the right-hand

head. Both heads are fed toward and away from the work at an angle of 14 degrees to reduce wheel wear and diminish the chance of wheel breakage. All three wheels are automatically dressed after grinding thirty-five worms by means of hydraulically controlled diamond tools. The face of the wider left-hand wheel is dressed to grind two different bearing surfaces and the connecting chamfer and also to finish the thrust face on the collar. Compensation for wheel dressing is automatic. Vitrified-bond, aluminum oxide abrasive wheels, 30 inches in diameter, of 70 grain size and No. 6 structure are employed.

During the automatic grinding cycle, each wheel-head, together with its slides, is rapidly traversed to within 0.001 inch of the work on the sub-base of the machine. Hydraulic valving then moves the wheel-heads forward, independent of the stationary slides, with a controlled diminishing-feed-rate motion. An adjustable time delay is provided for sparkout, and then the wheel-heads are rapidly returned.

An important feature of these machines is the use of a feed-back air-gaging unit to automatically adjust the grinding wheel heads, when required. The finished worm is removed from the grinder and placed on the air-gaging fixture of the unit, as seen in the heading illustration, while another part is being ground. Three Sheffield Lectrolair units are provided to gage one of the bearing surfaces ground by the left-hand head, the bearing surface finished by the right-hand head, and the thickness of the worm collar. Each division on the Lectrolair gages represents

0.000025 inch. If the worm is under size, the machine is stopped automatically. However, if the dimensions are approaching the allowable limits, information is fed back to the machine, and the wheel-heads are automatically compensated by resetting to as little as 0.0001 inch. In this way, no more than one unsatisfactory worm can be produced before corrections are made.

Mating nuts for the power-steering systems are made from SAE 5120 hot-rolled steel bar stock, 2 5/16 inches in diameter. Blanks are faced, chamfered, turned, shaved, drilled, and cut off on Cone six-spindle, automatic bar machines. By employing a full width, high-speed steel shaving tool at the fourth cutting position of each automatic, and providing a roller support and anvil to reinforce the work, tolerance on the outside diameter of the nut is maintained within plus or minus 0.0005 inch—thus eliminating the need for centerless grinding. From 0.005 to 0.007 inch of stock is removed per side by the shaving tool, which is held in a special V-shaped holder that is adjustable in all directions.

Ball grooves are cut in the nut bores on Barber-Colman hobbing machines. Lead and depth of cut are controlled by cams, and rough- and finish-machining are completed in one automatic operation. The nut is clamped in a hydraulically operated fixture, Fig. 5, locating from the previously broached processing slot by sliding the part over a key in the fixture. Cutting is done by a special milling cutter which is advanced to position and then fed toward the work. The outboard end of the cutter is supported by a carbide bushing. Grooves are kept parallel with the periphery of the nut within 0.0015 inch per inch and concentric within 0.002-inch total indicator reading.

Any burrs thrown up in the tube-return holes are removed by an end-mill mounted in an Allen drill press. The tapered hole for the retaining screw is drilled and reamed on a Hartford Special trunnion machine. Thus, the copper plate is removed from the ball grooves and screw holes, and only these surfaces are hardened when the nuts are carburized. Case depth of the hardened areas is held to a maximum of 0.060 inch before grind-

Fig. 6. About 0.010 inch of stock is removed from ball grooves in ten passes on this internal grinding machine.

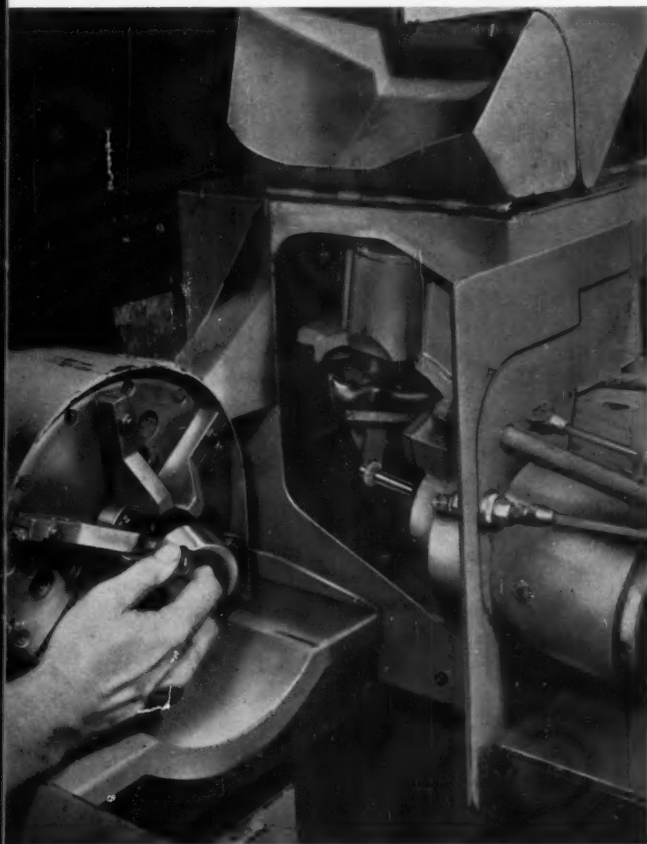


Fig. 7. Impression of internal ball groove in nut, made from a low-melting alloy, is checked on this optical comparator.





Fig. 8. Sub-assembly area in which nuts are selected from size classification chutes seen at the left center and mounted on correct worms taken from the bins seen at the right.

ing. As with the worm, the case depth at the ball grooves must be at least 0.035 inch after grinding, and the maximum case thickness allowed to be ground off on any surface is 0.010 inch. Hardness after tempering is 60 to 62 Rockwell C.

Peripheries of the nuts are finished on a Cincinnati cylindrical grinding machine. An Ex-Cell-O internal thread grinder, Fig. 6, is used to finish the ball grooves. The nut is gripped in a Woodworth air-operated diaphragm chuck, with coolant oil and air passing through the headstock spindle. About 0.010 inch of stock on the surface is removed in ten passes, with the wheel being automatically diamond dressed after six passes. The 1-inch diameter wheel is rotated at 21,500 R.P.M. by means of a high-cycle spindle. After washing and degreasing, the nuts are inspected prior to assembly.

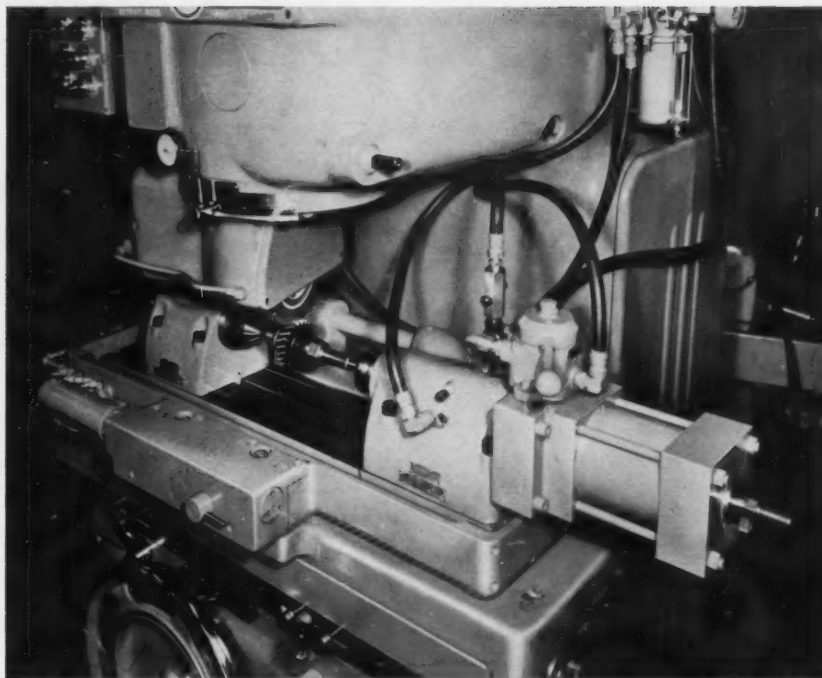
Every thirtieth part produced is given a complete final inspection, and, if not satisfactory, the preceding twenty-nine parts are checked. Also, a part from each grinding machine is checked once per hour. The ball groove in the steering worm is checked for size, form, and ball-ride points on a Jones & Lamson optical comparator and measuring machine at 62 1/2 magnifications. A shadow, cast on the screen by the illuminated worm, must fall within the contours scribed on the glass to represent the maximum and minimum acceptable limits. Contact points are checked by clamping

a ball template, 62 1/2 times size, over the screen and moving the work-table.

Since it is not possible to check the internal ball groove of the nut in this way, a partial impression of the groove is made from a low-melting alloy; and this is inspected. The nut is placed on an arbor and supported by a V-block while molten Cerro-Low alloy is poured through a hole in the arbor. The alloy flows around the internal ball thread groove of the nut and solidifies. Then the nut is unthreaded, and the arbor with cast impression of the ball groove is placed on the comparator for checking, as seen in Fig. 7.

Taper, lead, and runout of the ball groove on the worm are inspected on an Illinois Tool Works hob lead measuring machine. Size readings are recorded on a graph. A Vinco gage is used to check the pitch diameter of the worm groove and sort the worms into ten classifications.

A Sheffield single-column air gage is used to sort the worms into additional size classifications, and they are placed in bins shown at the right in Fig. 8. Meanwhile, twenty-three pre-selected size balls are automatically loaded into each nut and assembled to an arbor with a retaining strap on a special Saginaw-designed machine. These sub-assemblies are placed in size classification chutes, as shown. Then, an operator selectively fits the proper size ball nut to the correct worm, thus insuring precise fitting.



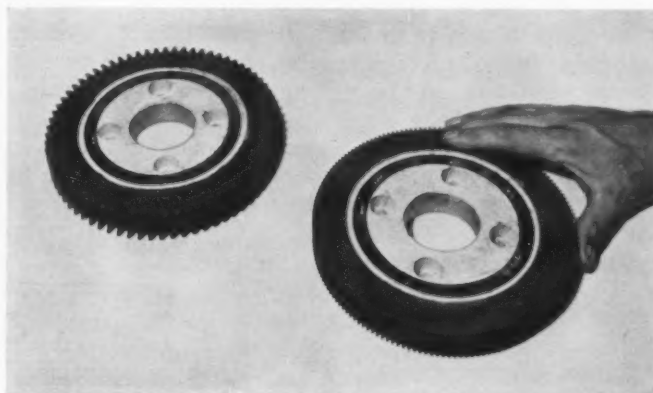
Hardened Gear Teeth Are Finished by Honing

HONING now joins grinding, lapping, and burnishing as a practical means of finishing hardened gear teeth. The process improves surface finish and sound qualities, removes nicks and burrs, and corrects any small errors in spacing, profile, lead, or concentricity produced in heat-treating. It can be adapted economically to both high and low production schedules.

A unique honing tool and two models of ma-

chines have been developed by the originator of the process, the National Broach & Machine Co., Detroit, Mich. Two of the tools appear in Fig. 1. Essentially, the tool is an abrasive-impregnated helical gear that is run at high speed in mesh with the hardened work gear in crossed-axes relationship. The work gear is driven by the honing tool and, also, traversed back and forth across the honing tool in a path parallel to its axis.

Fig. 1. The helix angle of the honing tool is determined by the helix angle of the work gear and the amount of the crossed-axes angular setting.



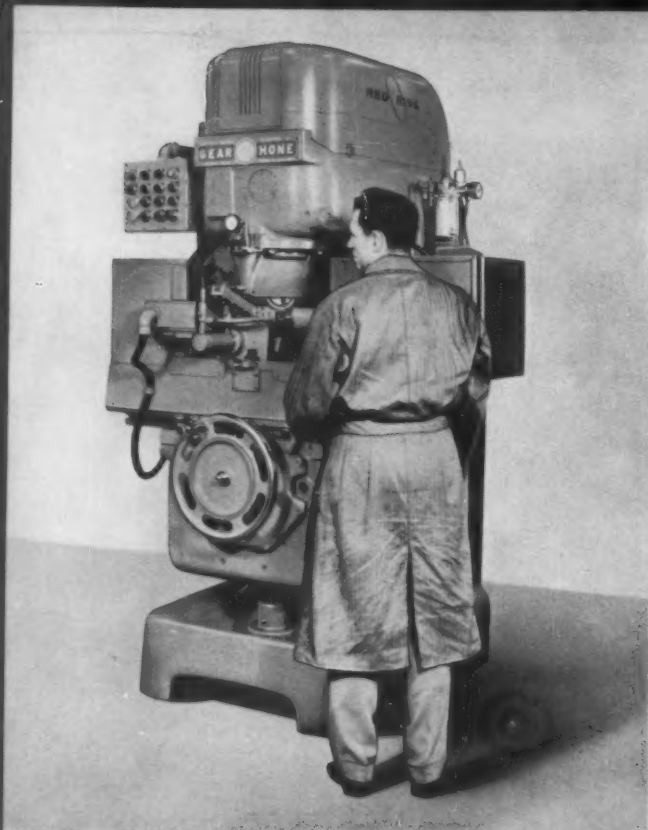


Fig. 2. This gear honing machine is equipped for entirely automatic operation. The rocker type loader is air-operated.

During the operation, the gear is run in both directions. The honing tool is perishable, being discarded at the end of its useful life.

A close-up view of a setup on one of the machines is shown in the heading illustration. The work-piece is a helical gear for an automobile

transmission. A feature of the machine is its two-piece table construction.

The inner table—forming a base for the headstock and tailstock—is connected to the outer table by a hinge mechanism. (The hinge can be seen behind the work-arbor.) During honing, the inner table is level, as illustrated, and reciprocates as a unit with the outer table.

To unload and reload the machine, the operator tilts the table down by means of an air cylinder. The valve controlling this cylinder is located on the front left end of the outer table. With the table tilted, the tool and gear are out of mesh. When the machine is reloaded, the inner table is tilted upward until the tool and gear mesh without backlash. It is then locked.

The work is driven at high speed—about 800 surface feet per minute. To facilitate loading, the tailstock also is air-operated. If desired, the tilting table action can be locked out to permit honing under low backlash conditions with brake loading.

The other model honing machine, Fig. 2, is shown equipped with an automatic work loader. Headstock and tailstock spindles are designed to operate around 3000 R.P.M. A unique method of mist lubrication of the bearings produces a flushing action that cleans them continuously.

Graphite “Welded” for First Time in History

Two scientific achievements of world-wide significance were announced at the recent dedication of the Parma, Ohio, research laboratories of Union Carbide and Carbon Corporation's National Carbon Division. Scientists have discovered for the first time in history how to “weld” pieces of graphite together. The technique suggests the possibility of prefabricating sheets and panels for the assembly of nuclear reactor moderators which now must be built up from graphite blocks. Graphite is an essential material in nuclear reactors because of its neutron-slowing ability, which makes possible the self-sustaining chain reaction necessary in harnessing nuclear energy.

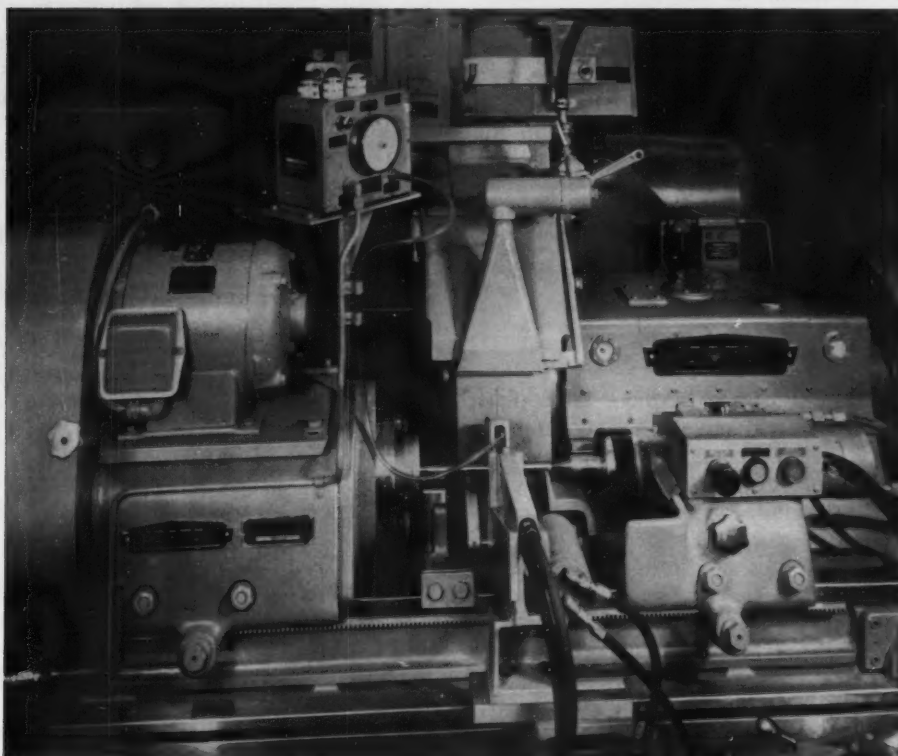
The second achievement was the production in the new laboratories of the largest single crystals of cadmium sulphide. A light-sensitive material, cadmium sulphide can be used in photo cells and solar batteries, and when properly acti-

vated, as a light-producing phosphorescent material, it is claimed.

Research at Parma can be described broadly as embracing four major fields of interest—solid state physics (and closely related chemical physics), electrochemistry, carbon and graphite research, and development of high-temperature processes and refractory compounds. The laboratories contain approximately 175,000 square feet of floor space. Designed for both flexibility and expansion, the main building comprises 158 modules, or individual research units. Each module is fully equipped with service lines providing various electrical voltages and laboratory gases. Rare gases can be piped in for special experimental work.

Supplementing the laboratory facilities are adjacent wings, housing the chemical engineering and laboratory furnace areas, machine shop, dispensary, library, and administrative offices.

Machine-Control Gaging



Gaging which performs the functions of inspecting work, changing the speed or direction of a machine tool spindle or slide, and signaling a needed resetting of a machine tool member—termed machine-control gaging—is a logical step in industry's refinement of automated processing. Described here are two general methods of such gaging, as well as four of the control systems available.

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AT what point should management consider the adoption of machine-control gaging? This question can only be answered by a thorough study of the operations involved. Of paramount importance is whether the gaging can be justified by dollars-and-cents savings. In the first place, the machine tool must be in good enough condition to produce work to the required tolerance. All the gaging in the world cannot assure good work from a machine which has lost its inherent accuracy and response through wear. Only when a machine is within at least 60 to 70

per cent of the tolerance range of the work can the control gage operate successfully.

A manual gaging method might consume too much of the operator's time, or, to meet a production schedule, he might have to work too fast, and as a result turn out too many off-sized pieces. Either condition could indicate the advisability of machine-control gaging. Again, the need for such gaging might become apparent where work spoilage can be traced to operator fatigue, particularly if extensive or costly previous operations have added substantially to the value of the work.

Or, dimensions after roughing operations might vary too widely. Here, machine-control gaging assures that finishing is within tolerances.

Another condition favorable to machine-control gaging, of course, is where production lots are large. Even a small saving in machining and gaging time adds up to a sizable figure on a long run. Machine-control gaging can cut the time cycle, and the operator can serve more than one machine. Finally, an established control method, like using a timer and a fixed stop on a grinder, might be incapable of signaling the machine to stop at the desired size. Machine-control gaging would give better command of the operation.

In-Process Gaging

In-process gaging of a work-piece takes place while metal is being removed. A diagrammatic representation of in-process gaging appears in Fig. 1. Various machine functions can be combined with the gaging. For example, on a cylindrical grinder, the gage can signal the wheel to change from a fast to a slow in-feed, then signal wheel back-up when the work reaches required size. On an internal grinder, it can start a wheel-dressing cycle at a predetermined bore size and stop a grinding cycle when the work reaches the desired finish size. An in-process gage can also indicate by signal lights when a piece is over, near, and at finish size. Gaging action is positive and not affected by any degree of variation in the rough dimensions of the work.

One of the limitations of in-process gaging is that it controls *random size deviation* only and cannot compensate for *cumulative deviation*, or machine drift. Even a machine in good condition will drift; that is, produce work gradually changing in size as it gathers the heat generated by machining, as well as the heat of its own operation. Drift can also be traced to the build-up of heat in the machine coolant during the day.

Still another cause for the average size to

change gradually from piece to piece is found in hydraulically operated machines. As the hydraulic fluid absorbs heat, it becomes less viscous, and the machine tends to run faster and to generate more heat in the work. In the case of a hydraulic grinding machine, the momentum of the wheel tends to carry it farther into the work as the viscosity of the fluid used to drive the wheel-head is reduced.

An in-process gage is also unable to detect changes within itself because of its own temperature variations and the wear of its gaging-member contacts. A gage set up, for instance, to control an internal grinding operation might have an air plug reciprocating in the hole. As the wheel finishes grinding and retracts through one end of the hole, the plug enters immediately from the other end to gage the work. Conceivably, the air plug could heat up to a point where its accuracy is affected—all without the gage correcting its own error. Likewise, contacts can wear with no indication by the gage.

Post-Process Gaging

The post-process gage, usually located next to or on the machine tool, automatically inspects dimensions of each piece after machining is completed. It can perform a number of essential functions, such as: allow good pieces to pass on to the next operation; sort good pieces into size categories; reject bad pieces; stop the machine upon detecting a predetermined number of bad pieces; compensate for drift by adjusting the machine when marginal tolerance limits are exceeded; and stop the machine in case of tool failure. This method of gaging is illustrated by the diagram in Fig. 2.

Unlike the in-process gage, the post-process gage is not exposed to the temperature fluctuations of the machine and is thus able to detect and control cumulative deviation caused by machine drift. But to control drift properly, the post-

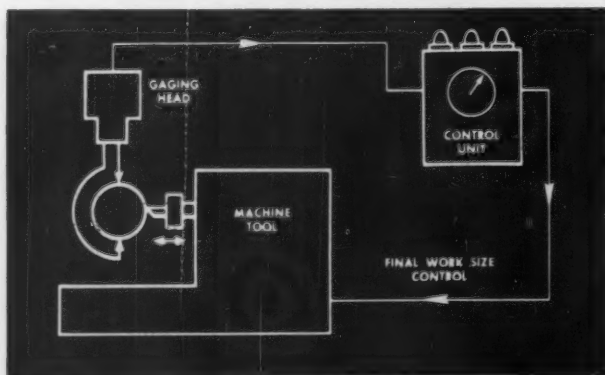


Fig. 1. In in-process gaging, the work is inspected while it is being machined. The gage becomes part and master of the machine, so that all pieces produced are acceptable.

process gage must be able to ignore piece-to-piece size variation. To do this, the control points of the gage are established at marginal limits within the dimensional spread representing the capability of the machine. This almost always places these limits within the tolerance of the work. The separation between these points is great enough to allow for almost all of the random size variation of pieces produced when there is no machine drift, so that no control is exercised by the gage until drift has actually occurred.

One or more consecutive pieces falling outside the marginal limits but within the total work tolerance will be allowed to pass before corrective action is taken. (The exact number of such pieces allowed to pass depends on how close to the tolerance extremes these limits are set.) This arrangement virtually assures that every piece, except for an occasional "flyer," will be produced within the prescribed tolerance, because compensation is made for machine drift before it has progressed to the point where bad work is being produced. The type of machine, work tolerance, and type of operation, all have a bearing on where marginal limits will be set. In any case, the control gage will be set to stop the machine if corrective action fails, as evidenced by too many pieces outside the tolerance extremes.

Post-process gaging can be applied to a greater variety of operations than can in-process gaging. For example, where a part has several dimensions, it is usually practical to check only one dimension with in-process gaging because of inaccessibility to the gaging members. Thus, a part with two adjacent diameters ground with a stepped wheel would have only one diameter gaged, with the other assumed to be correspondingly precise. But one section of a stepped wheel can wear faster than the other, so the second diameter could be incorrect. A post-process gage, on the other hand, checks both diameters. If either is out-of-tolerance, the gage can then signal a wheel-dressing cycle or stop the machine.

Another advantage of post-process gaging is

that, because of its high speed, it can be applied to one or more machines, either collectively or in sequence. Again, this method of gaging is performed under optimum conditions, free from the effects of coolant splash, heat, and machine vibration. Accurate measurements are obtained, since the work cools off in the interval following machining and is close to normal room temperature.

A post-process gage should be located near the machine tool wherever possible. Otherwise, too many bad pieces can be produced before correction to the machine setting is made.

Pre-Process Gaging

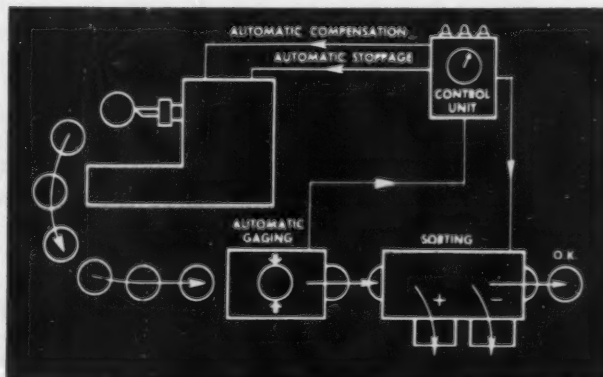
Pre-process gaging is not a distinctly separate method, as it may be considered sometimes a part of the post-process gaging of a previous operation. Its job is to check incoming work to avoid damage to the machine or tooling. A pre-process gage, for example, might be checking work for an internal grinder. It would reject any pieces with holes so small as to break a grinding wheel fed to the work.

The same gage may operate for both pre-process and post-process gaging. One company uses a post-process gage on a battery of six screw machines, working to a 0.005-inch tolerance, as the pre-process gage for grinding machines. It sorts out pieces too far out of size for grinding, and after inspecting a series of bad pieces, signals the machine to shut down and the operator to make necessary adjustments. Such a gage need not be too refined; that is, it can have fairly broad discrimination as long as it does an adequate policing job.

Combination Gaging

Benefits of both in-process and post-process gaging can be had by combining both types, as shown in Fig. 3. The in-process gage exercises close control over random deviation, and the post-

Fig. 2. In post-process gaging, the work is inspected after machining has been completed. Since bad pieces as well as good pieces reach the gage, sorting becomes an integral part of the inspection.



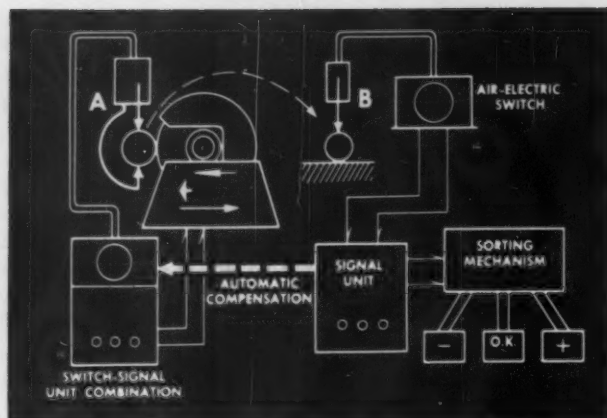


Fig. 3. In combination gaging, when a prescribed number of pieces have exceeded either marginal tolerance limit, post-process gage (B) signals in-process gage (A) to correct the wheel-retraction setting.

process gage controls machine drift. When correction for drift is necessary, the post-process gage signals the in-process gage to reset its zero point. Resetting can be done either in specific increments or in proportion to the size variation noted by the post-process gage.

An automotive company has installed grinding machines equipped with combination gaging to manufacture transmission parts to a tolerance of 0.001 inch. Even with such a relatively large tolerance, combination gaging was specified because of the high production rate. Extremely fast grinding cycles introduce errors, so a thorough gaging and policing job was considered necessary to keep production high.

Electric and Air-Electric Gaging Systems

All gaging methods can be controlled by one of four different systems—electric, air-electric, electronic, or air-electronic. The advantages and limitations of each will be considered.

An electric system, like the one based on the Federal Electricator, combines a dial indicator with a dual switch mechanism. It is adaptable to both in-process and post-process gaging. Electric in-process gages have controlled part size to within 0.0002 inch, and even finer in some instances. On a grinding machine, an electric in-process gage provides either single-limit control, by retracting the grinding wheel when work reaches its finish size, or double-limit control, by first changing wheel feed from fast to slow at the proper point in the grinding cycle and then retracting the wheel when the work reaches its finish size. Signal lights show over-size, near size, and finish size as the part is ground.

Single-limit control is adaptable to most existing plunge type cylindrical grinders having an electrically actuated hydraulic wheel-slide mechanism. For machines with a lever type wheel-

slide control, an external solenoid is added. Double-limit control is usually limited to new machines, since, ordinarily, older machines are not designed for easy adaptation. But single-limit control might not be precise enough. Keeping the rate of wheel feed high until finish size is reached and then immediately retracting the wheel does not produce work as perfectly round as when a spark-out interval is included.

If the work must be more precise, a variation of double-limit control can be provided. The fixed stop on the machine is set so that the wheel feeds in rapidly until work-piece size is 0.0003 or 0.0004 inch over the finish size. Then the wheel feed stops, and there is a dwell during which the gage controls the machine, retracting the wheel when the work sparks out to finish size.

Employed for post-process gaging, the electric system sorts work into over-size, within-size, and under-size classifications, indicating the classification of each piece as it is gaged. A control counter can be added to shut off the machine after a predetermined number of out-of-tolerance pieces have been gaged.

The principal advantage of the electric control system is its relatively low initial cost. It is, however, restricted in application because of a mechanical switching mechanism which sets definite limits to speed of operation. (Top speed is about 80 to 100 pieces per minute.) Also, its mechanical motion transfer makes it susceptible to vibration and inertia. The physical size of the system limits its adaptability in restricted areas.

Electric machine-control gages are generally used where tolerances are wide (0.0005 inch or more). A typical application would be as a post-process gage to measure the depth of penetration of a solid plug, such as a stepped-diameter plug, in checking hole size. The plug would be connected by a lever to the Electricator which, in turn, would be electrically connected to a signal unit for sorting good and bad pieces.

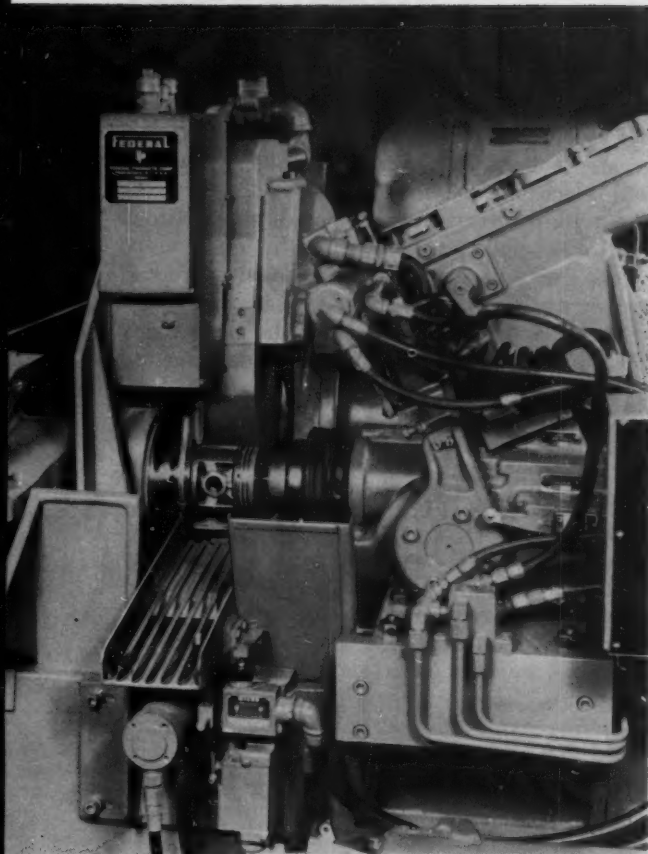


Fig. 4. A piston is cam-ground on a machine equipped with an electronic in-process gage. This type of gaging provides the necessary speed of response required for the operation.

An air-electric system, on the other hand, combines air gaging with electric control and offers important advantages over straight electric control. A correctly designed air-electric system is not susceptible to vibration. Its switching mechanism, which establishes an electrical impulse as a result of changes in air pressure from dimensional variations, has a steadier, more reliable make-and-break contact. Repetitive accuracy is better, as an air-electric gage has less friction than the mechanical arrangement in an electric gage. The control mechanism can be placed away from the area of actual machining.

The heading illustration shows the in-process gaging of a small shaft during a cylindrical grinding operation. An air-electric "jump-on" caliper checks the outside diameter. To the right of the caliper is a hydraulic cylinder by which the caliper is moved into or out of gaging position. It operates in unison with the hydraulic cylinder of the wheel-head.

Post-process gaging by an air-electric system sorts pieces and controls the machine in the same way an electric system does. It can also sort good pieces into size categories for selective assembly and can signal the machine to correct for drift.

It is of particular value where contact between the gaging member and the work surface is to be avoided; where close tolerances (under 0.0005 inch) are required; or where several dimensions in a given area must be gaged, and only air probes or air jets can gain access. This system is readily adaptable to external grinders, internal grinders, surface grinders, and many other types of machine tools.

The air-electric system should not be used if more than a few sorting categories are needed. Without auxiliary equipment it is fairly slow and is limited in post-process gaging to about twenty-four pieces per minute.

Electronic and Air-Electronic Gaging Systems

Electronic systems, applied to external measurements, can provide single- or double-limit control, just as electric and air-electric systems do. An electronic gaging head produces its gaging signal by an air-gap coil energized by an oscillator. The induced voltage is directly proportional to spindle displacement. After being amplified and rectified, the voltage is fed to an electronic classifier for sorting and control functions.

Electronic in-process control gaging is of particular value for oval-shaped work, as it can measure one dimension while ignoring a second dimension. It can also ignore slight chucking eccentricity and can average two dimensional variables. The amplitude of its signal varies with respect to the dimension being measured: that is, voltage difference is directly proportional to dimensional difference. The output can be fed to a recorder, to a proportional controller (to correct to zero without introducing machine hunting), or to a classifier for sorting.

An electronic in-process application is shown in Fig. 4. Here, the outside of a piston is cam-ground to a tolerance of plus 0.000, minus 0.0005 inch. The gage ignores the minor diameter. It changes wheel-feed rate of the grinding machine near the finish size and retracts the wheel when the major diameter reaches finish size. The two jaws of the caliper are movable to permit checking eccentricity.

For post-process gaging, an electronic system is capable of high precision (to 0.00001 inch) and high speed (700 pieces per minute). Speed is limited by the mechanical capability of the hopper or feed mechanism. An electronic system can sort work into as many as twenty-two categories

and indicate the classification of each piece. With a control counter, it can signal the machine to stop after a predetermined number of bad pieces have been gaged or can adjust the machine immediately or after a predetermined number of pieces have exceeded control limits.

Electronic machine control so far has been applied only to job requirements of an advanced nature. It has a higher price tag than the electric or air-electric gage, and its size does not permit adapting it readily to gaging of internal dimensions.

Combining air gaging with electronic control adapts the system to the inspection of inside diameters and other internal dimensions. An air plug is particularly useful for inside measurements because of its shape and size. Pressure variation from the plug is converted to an electronic signal by an air-electric transducer. Diaphragm movement in the transducer causes corresponding movement in an air-gap coil and generation of the signal.

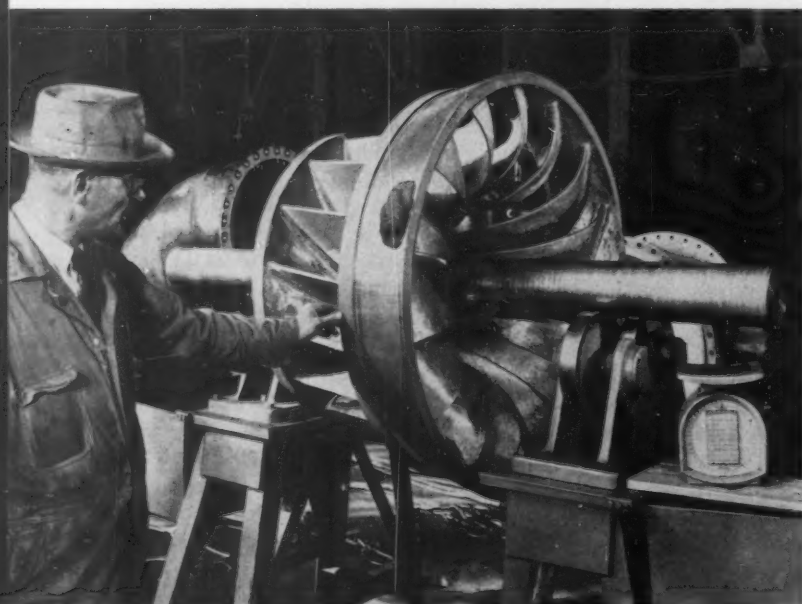
Air-electronic control has not yet been applied to in-process gaging because of its relatively high cost compared to that of air-electric control. The latter is adequate for gaging requirements encountered so far, but air-electronic control will be easily adapted to gaging of involved measurements when gaging conditions warrant its use. Thus far, its principal application has been to gage and sort parts that must be mated for selective assembly. It produces, in general, the same

results as electronic gaging, but for internal, rather than external, measurements. It is faster than air-electric control (approximately sixty pieces per minute compared to twenty-four pieces per minute) and can sort pieces into a greater number of categories—twenty-two, as with electronic control.

A typical sorting operation with air-electronic control is being accomplished on hydraulic valve lifters. Cup and piston can both be out of round, as long as they mate with specific average clearances of 0.0003 to 0.0005 inch. If the clearance is greater than 0.0005 inch, the piston may collapse into the cup and render the lifter useless. Less than 0.0003-inch clearance, and too little leakage around the piston, may freeze the mated parts.

Selecting the Method and the System

Selection of the best gaging method and system may be even more difficult than determining at what point machine-control gaging should be adopted. Frequently, the decision centers on whether new machines should be bought or whether older machines should be converted. Many companies have gage-engineering departments that analyze their requirements and design or specify adequate gaging systems. Others, without such specialized personnel, nevertheless have highly competent sources of information open to them—the machine tool manufacturers or the gage-makers themselves.



Balancing a Francis runner for a hydraulic turbine at the S. Morgan Smith Co., York, Pa. The runner is a 1775-pound steel casting, furnished by Empire Steel Castings, Inc., Reading, Pa. In preparing the work for balancing, the core is bored and a bushing inserted to receive a mandrel which rests on two sets of rolls. Temporary weights are attached at required points. Then, when the casting is in balance, the weights are removed and noted. Ordinarily, balance is obtained by lightening appropriate area of the runner band. This is done on a vertical boring mill. With the casting offset from center the required distance, a cut of predetermined width is taken. As a guide to the amount of metal removal, the chips are saved and weighed. Later the runner is returned to the balancing equipment for a final check. Other runners weigh up to 10,000 pounds yet can be balanced to within 8 to 10 ounces in from six to eight hours.

INGENIOUS

Mechanisms

Mechanisms selected by experienced machine designers as typical examples applicable in the construction of automatic machines and other devices

Shock Absorber for a Rotating Shaft

By W. M. FOSTER, New Hyde Park, N. Y.

Heavy shock loads to which a shaft was subjected were isolated from the gearing driving the shaft by the mechanism illustrated. Over-all timing of this shaft with other shafts had to be maintained—one revolution of the shaft in question always had to equal one revolution of the others—so a friction drive was ruled out because of slippage.

The shaft *A* carries a large gear *B*. This gear is free on the shaft, running over a bushing and meshing with a constant-speed drive gear *C*. In its face, gear *B* contains a poppet stud *D* which rotates with the gear but can also swivel for alignment.

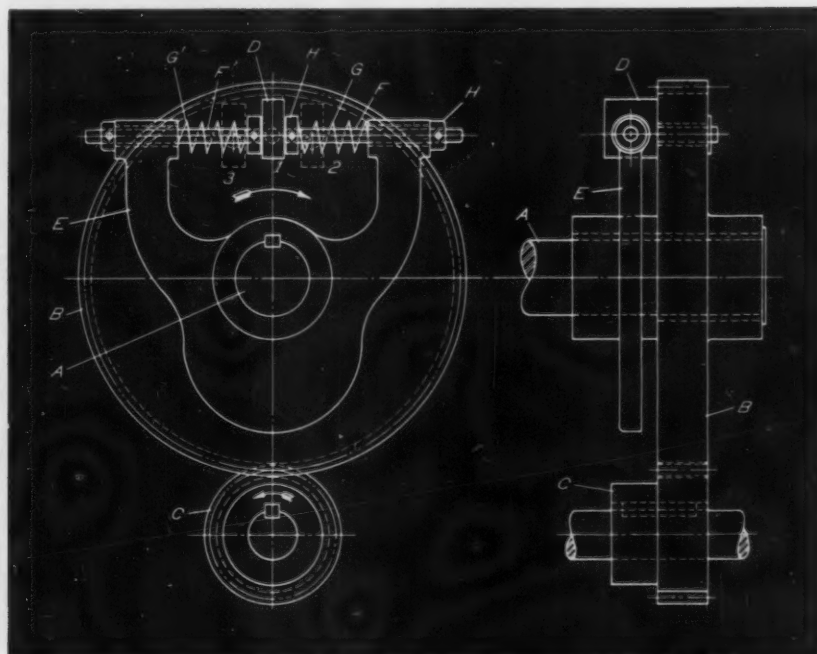
A double-arm bracket *E* is keyed to shaft *A*. Through a boss on each arm of the bracket is fitted a spring-rod *F* or *F'* which is free to slide and carries a compression spring *G* or *G'*. Stop-collars

H confine the springs and limit the amount of movement of the spring-rods. The lower part of the bracket serves as a balance.

In operation, gear *C*, running counterclockwise, drives gear *A*, running clockwise, at a constant rate of speed. The poppet stud transmits the drive through spring *G* to bracket *E*. Since spring *G* is heavy enough to carry the normal drive force without further compression, bracket *E*, and thus shaft *A* rotate in unison with gear *B*.

When a shock load tending to *retard* rotation is encountered by the shaft, the bracket and shaft momentarily resist rotation, and gear *B* continues to advance, carrying the poppet stud forward from its normal position "1" to a position such as "2," at the same time compressing spring *G*. The time required to compress the spring prevents the shock load from extending to the gearing.

The mechanism is able to isolate shock loads from the gearing without interfering with the over-all timing of the shaft.



As soon as the shock load diminishes, the spring returns the poppet stud to its central position "1." Likewise, when a shock load tending to *advance* rotation is encountered, the bracket and shaft move ahead, causing the poppet stud to assume a position such as "3," and compressing spring *G*'.

The two springs do not oppose each other. The stop-collars *H* are located and pinned in position so as to allow a slight play of the poppet stud. Thus, any motion away from center acts against only one of the springs, compressing it independently until the shock load diminishes.

Escapement Mechanism Feeds Rods of Various Diameters

By B. F. WOODCOCK, Houston, Tex.

Round bar stock of random diameters can be fed one at a time, regardless of the differences in diameter of adjacent bars, by a battery of identical escapement mechanisms that operate from a common drive-shaft. The design and operation of this device are shown in the accompanying illustration.

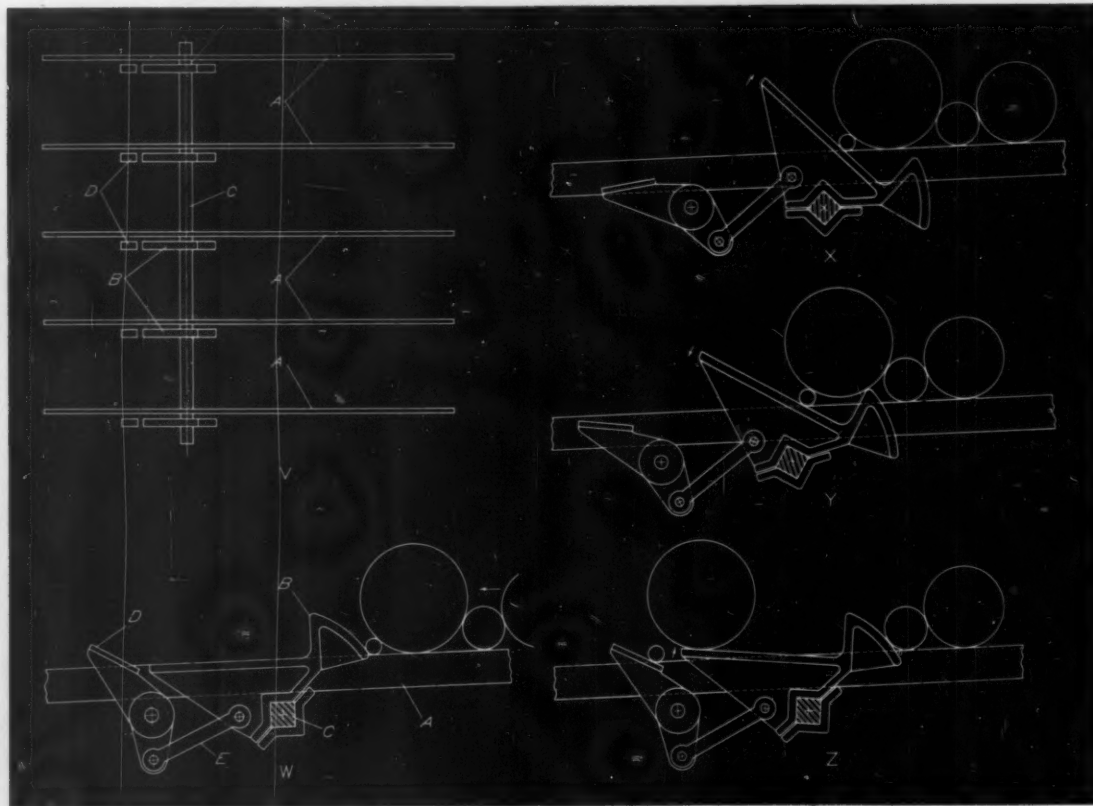
The rods are loaded on a feed-table consisting of parallel steel strips *A*, as can be seen in the plan view at *V*. To encourage the rods to roll of their own accord, the table is set up with a slope of approximately 1/2 inch per foot. When the escapement mechanism is in neutral position, as

shown in view *W*, the rods are restrained from rolling by the heel portion of feed-arm *B*. The radius of the curved surface of the heel has its center coincident with that of square drive-shaft *C* on which all of the escapements are mounted.

By using a square shaft, the task of cutting numerous keyseats to accommodate the various escapements is avoided. Round bronze journals are locked on the shaft by set-screws at each bearing location. The shaft may be rotated either directly by lever or indirectly by an air cylinder.

To initiate the delivery cycle, shaft *C* rotates in a clockwise direction through an arc of 45 de-

Escapement mechanism permits feeding of round bar stock of assorted diameters. Arms (*B*) and (*D*) function together to allow only one rod at a time to be released, regardless of its diameter.



grees, ending up in the position illustrated in view X. This permits the entire stock of rods to roll forward until the first rod strikes the long edge of feed-arm *B*. A short dwell period is provided to allow all the bars to complete their forward travel. Shaft *C* then moves in a counter-clockwise direction, view Y, until the mechanism has returned to its original position, trapping one or more rods in the space between feed-arm *B* and stop-arm *D*.

During the next clockwise movement of shaft *C*, view Z, stop-arm *D* is lowered, permitting the first rod to roll away. At the same time, feed-arm *B* begins to rise, causing the second bar to roll backward. This is due to the spacing between the two arms which maintains the center of gravity of the second bar to the right of the end of arm *B*. Link *E* that connects arms *B* and *D* should be adjustable to facilitate alignment of all the stop-arms across the width of the feed-table.

Simple Device Allows Manual Overriding of Remotely Controlled Lever

By F. TROSTLER and S. BRUELL, Haifa, Israel

Requirements for the control of a lever on a particular mechanism dictated that it be capable of being actuated either remotely, by a rotating shaft of limited movement, or manually, by a unit that will override the shaft. To disengage the lever from the shaft for manual operation, a device that would function with restricted movement was required.

A simple unit that fulfilled these demands is shown in the accompanying illustration. The lever is made in the form of an elongated split bushing *A*, having an integral extension *B*. Push-pull rod *C*, leading to the mechanism to be controlled (not shown), is secured to the integral extension by a cotter-pin.

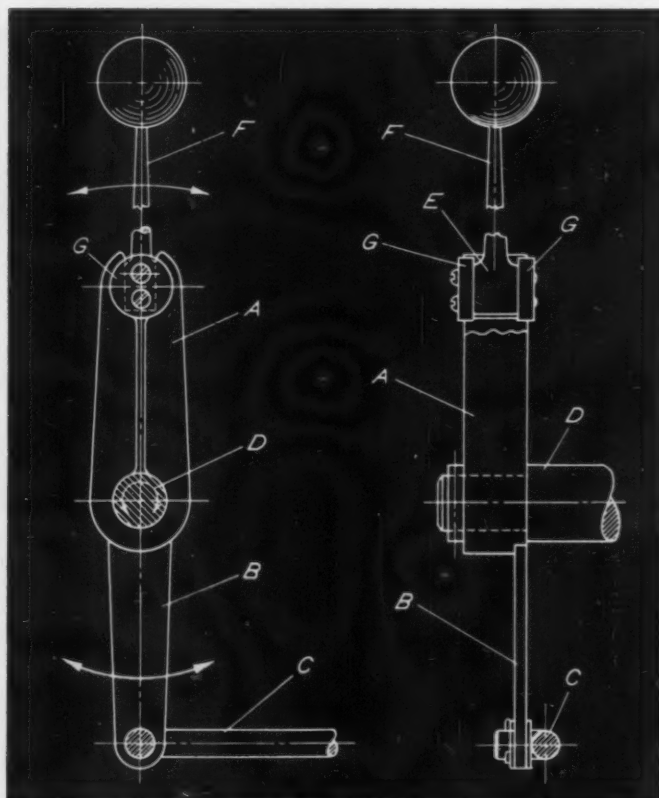
Split bushing *A* is a press fit on the reduced end of control shaft *D*. Therefore, the bushing, or lever, will move as a unit with the shaft so long as the bushing segments remain closed, as shown.

Fitting into the widened upper end of the split is a cam shape *E*, which forms the lower end of manual control arm *F*. Two discs *G* are screwed to the cam. They ride in recesses machined in the faces of the split bushing and serve two purposes: first, they retain control arm *F*; and second, they act as bearings during its movement.

When the control arm is forced to pivot across control shaft *D*, indicated by the upper arrow, cam

shape *E* forces the segments of bushing *A* to spread. This action causes the bushing to slip on the control shaft. Further movement of control arm *F* will result in the manual actuation of push-pull rod *C*, regardless of the position of control shaft *D*.

Because of its elasticity, the split bushing will spring shut as soon as the control arm is released. Therefore, the bushing not only resumes its grip on control shaft *D* but also returns the control arm to its neutral position.



Split bushing arrangement permits lever actuation by either manual or remote control.

Tools and fixtures of unusual design and time- and labor-saving methods that have been found useful by men engaged in tool design and shop work

V-Block Lathe Follower-Rest

By H. J. GERBER, Stillwater, Okla.

A homemade lathe follower-rest consists of a simple support for a V-block that takes the cutting thrust. In addition to the V-block, a few pieces of scrap-plate are required. The device is attached directly to the compound rest of the machine.

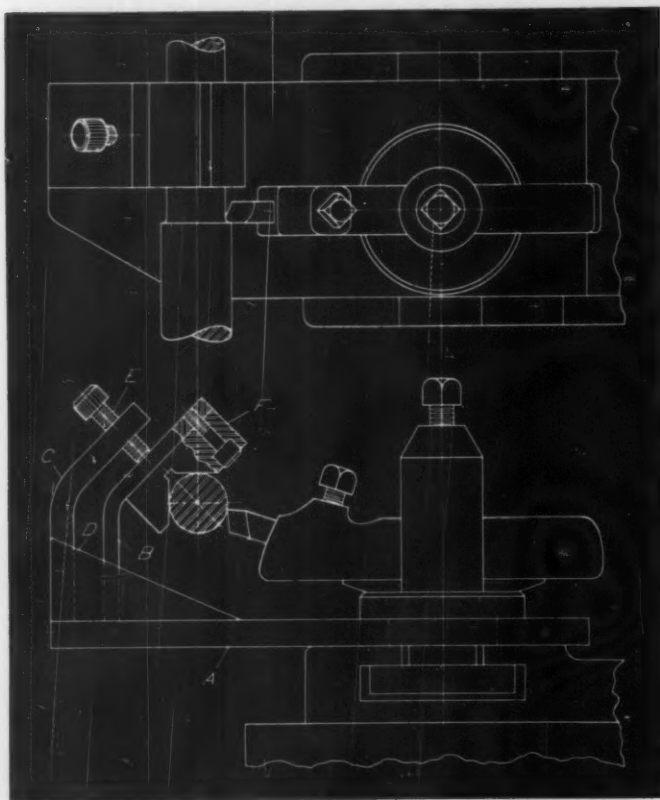
Baseplate *A* is bored to a loose fit over the toolpost, being secured in position by the toolpost assembly. V-block bracket *B* is welded to the baseplate, and its upper part is bent approximately 45 degrees, as illustrated. Back-stop *C*, located a

short distance behind the bracket, is similarly welded to the baseplate and bent. Added rigidity is furnished by gusset *D*, welded to both the baseplate and the back-stop but without physical connection to the bracket.

A tapped hole in the back-stop contains pressure-screw *E* which bears against the bracket and provides for fine adjustment of V-block *F* secured to the front of the bracket. The V-block may be either steel or bronze, depending on the nature of the job.

To set the follower-rest, the cutter is loosened in the tool-holder, and the cross-slide of the lathe is run up until the V-block makes contact with the work. The cutter is adjusted by tapping it forward by light hammer blows and tightened in the tool-holder. Then, pressure-screw *E* is advanced or retracted for fine adjustment. For exact calibration of cutter infeed, a dial indicator can be clamped to the baseplate and brought into contact with the rear of the tool-holder to record the amount the tool-holder is advanced.

The purpose of having the body of the V-block at an incline is to prevent the work from climbing over the cutter. For extremely fine finishing with light cuts, a V-block of hard maple, end-grain contacting is recommended. It should be well lubricated in use.



Inclined at 45 degrees, the V-block prevents the work from climbing over the cutter.

Wheel-Pullers Function in Restricted Locations

By W. M. HALLIDAY, Southport, England

Effective application of conventional claw type wheel-pullers may be hindered by the proximity of other components which prevent adequate gripping of the claws or by relatively frail proportions of the wheel flange to be gripped. Two types of wheel-pullers designed to function satisfactorily in tight quarters, without buckling or otherwise damaging the wheel flange, are illustrated.

A typical sprocket wheel *A*, with its flange situated close to bearing bracket *B*, is keyed to shaft *C*, as shown at *X*. Body *D* of the extractor, which is machined from a steel bar, passes freely over the sprocket-wheel hub. Four through holes are drilled and tapped equidistantly around the right-hand end of the body. Fitted into each of these holes is a hardened steel hexagon screw *E*. The diameter at the tip of each screw shank is reduced to below the thread roots, forming a cylindrical dog. These dogs pass freely into shallow blind holes that are drilled into sprocket hub for extraction purposes only.

The end wall of the body is drilled and tapped to receive hardened steel pressure-screw *F*. The conical tip of this screw bears against the end of shaft *C*. With the dog ends of screws *E* engaging the holes in the hub as shown, pressure-screw *F* is rotated to exert pressure against the end of the shaft. This forces body *D* to the left, taking sprocket wheel *A* with it.

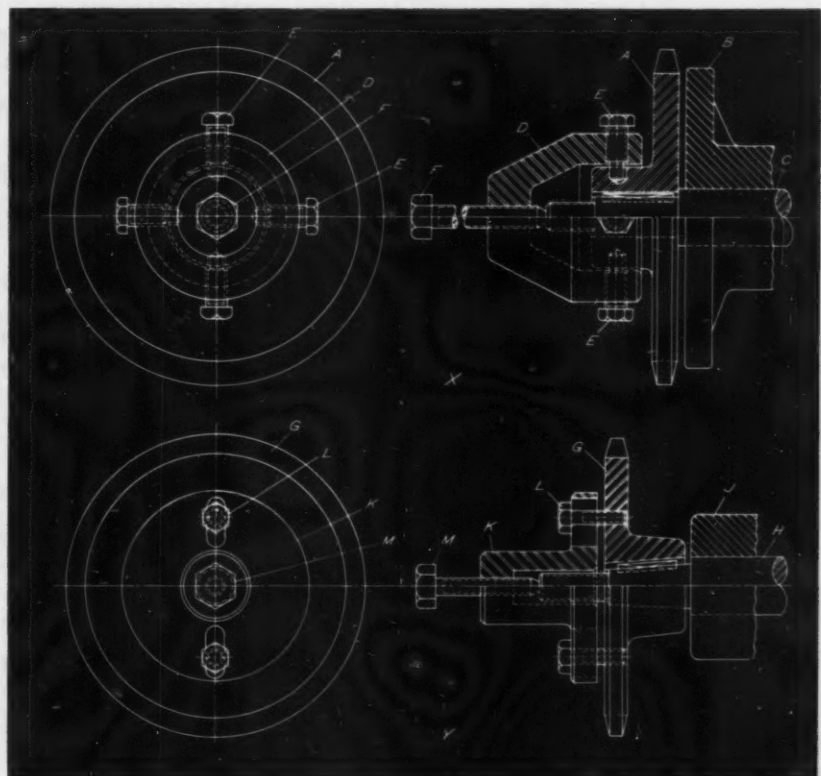
With similar types of sprocket wheels, mounted in this way, it is a simple matter to spot-drill the four blind holes around the boss. By removing the four screws *E*, body *D* may be used as a template.

At *Y* can be seen

an alternate design of wheel-puller intended for use in cases where a sprocket wheel or gear is mounted with its outside flange face accessible. In this example, sprocket wheel *G* is keyed to the tapered end of shaft *H*, which is supported by bearing bracket *J*. The flanged body *K* of the extractor is bored out along part of its length so as to slip over the smaller diameter at the end of the shaft.

Two slots, 180 degrees apart, are machined through the flange of body *K* to receive hexagon screws *L*. These screws are threaded into mounting holes that have been drilled and tapped through the flange of the sprocket wheel. The end wall of the extractor body is drilled and tapped to receive hardened steel pressure-screw *M*. The conical tip of the pressure-screw bears against the end of shaft *H*.

With the two screws *L* threaded into place, and pressure-screw *M* situated as shown, the wheel-puller is ready for use. By tightening the pressure-screw with a wrench, both the extractor body and the sprocket wheel will be forced to the left.



Two types of wheel-pullers designed for operation in close quarters.



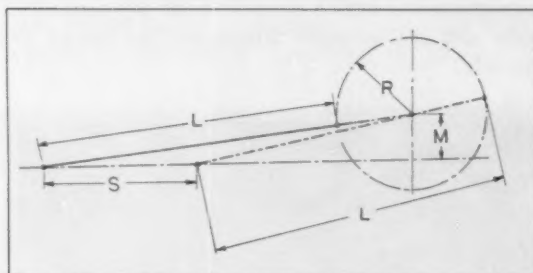
MACHINERY'S PROBLEM CLINIC

Mathematical problems in shop work and tool design submitted by readers of MACHINERY

Edited by HENRY H. RYFFEL

Determining Crank Radius for Power Shear with Specified Stroke

In designing a power shear with an offset crank, it was necessary to determine the crank radius needed to provide a 5-inch stroke. The accompanying diagram shows the crankshaft at



To determine the crank radius (R) for a given length of stroke (S), connecting-rod length (L), and crank offset (M) requires a trial-and-error calculating procedure

the farthest ends of the stroke. To determine the length of stroke S when the length of connecting-rod L , the crank offset M , and the radius of the crank R are known, the conventional formula used is:

$$S = \sqrt{(L+R)^2 - M^2} - \sqrt{(L-R)^2 - M^2}$$

How can this formula be rearranged so that R can be calculated if $L = 10$ inches, $M = 1.5$ inches, and $S = 5$ inches?

Solution:

There is no way to rearrange this formula to solve directly for R in terms of L , M , and S . A trial-and-error procedure must, therefore, be used.

First Trial

Let $R = 6$ inches

$$\sqrt{(10+6)^2 - 1.5^2} - \sqrt{(10-6)^2 - 1.5^2} = 15.93 - 3.71 = 12.22$$

Second Trial

Let $R = 3$ inches

$$\sqrt{(10+3)^2 - 1.5^2} - \sqrt{(10-3)^2 - 1.5^2} = 12.91 - 6.84 = 6.07$$

Third Trial

Let $R = 2.5$ inches

$$\sqrt{(10+2.5)^2 - 1.5^2} - \sqrt{(10-2.5)^2 - 1.5^2} = 12.41 - 7.35 = 5.06$$

Fourth Trial

Let $R = 2.48$ inches

$$\sqrt{(10+2.48)^2 - 1.5^2} - \sqrt{(10-2.48)^2 - 1.5^2} = 12.38 - 7.37 = 5.01$$

The result of the fourth trial shows that the value assumed for R , 2.48 inches, gives the required value of S within 0.01 inch. Closer values can be obtained by further trials.

Measuring Racks with Flush Pins

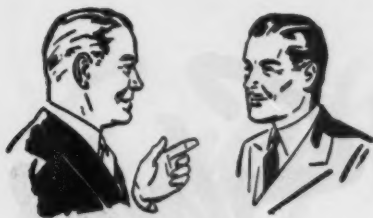
In the October "Problem Clinic," constants were given for racks made to the circular pitch system. Since most racks are cut to diametral pitch P , flush pin diameters D based on this system are as follows:

$$\text{For } 14\frac{1}{2}^\circ \text{ P.A. } D = 1.6167 \div P$$

$$\text{For } 20^\circ \text{ P.A. } D = 1.6096 \div P$$

$$\text{For } 30^\circ \text{ P.A. } D = 1.5736 \div P$$

Carl A. Johnson, Springfield, Ohio



Talking With Sales Managers

By BERNARD LESTER
Management Consulting Engineer

The Fourth Dimension

ONE of the most prized traits in a man is the ability to grasp the relation between time and event, and to apply this insight to each decision. Hindsight again and again shows that the success or failure of *what* was done depended upon *when*. Proper timing is an especially urgent trait of the sales manager. His plans must be linked to the time of execution. He lives in a mobile time-conscious world.

They say Einstein met a friend on a Princeton street during lunch-time. The two chatted a while. As they parted, Einstein asked, "When we met, in which direction was I going?"

The friend pointed, "that way."

"Thanks," answered Einstein, "that means I have had my lunch."

Yet this absent-minded man did more than any other to show us that in the realm of physical science, time is actually a fourth dimension. To visualize the relation of time to action in the business world just review experiences in your past or in the past of others. How many acts were misfits in relation to time? The inscription "Do it now" on the executive's office wall is often misleading.

As we size up those around us, we often hear a person described in terms of dimensions applied to his behavior. We all know men who are largely two-dimensional. Their thoughts, expressions, and actions are scattered skin-deep over a plane. Others we call three-dimensional, for depth is added to what they undertake to do. Then there are the few whom we might really call four-dimensional. Time enters in as one governing factor, and what they do finally counts, for their energy is released at a time of greatest need and acceptance.

The importance of linking time and action in the sales manager's work can be emphasized by picking out a few incidents from the notebooks of experience and observation. They show how careless we may be in recognizing the importance of time and getting time to work with us.

One machinery sales manager, alert to a constant need for younger manpower, approved a plan for selecting several recruits each year. The number selected was to be determined by the

state of business at the time, with no attention paid to the long training period required or to the consequences of supply and demand.

Two years ago the comptroller of a small corporation sold the sales manager on a sales-record system whose complexity and refinement built a monument in itself. Today this sales manager is busy "unloading ballast" caused by unwarranted time consumption.

Early spring was the time set by one supplier for the release of a promotional campaign on a line of new machines. Preliminary announcements were intended to coax potential customers to wait. Several elements of the campaign—including sales tools—were carelessly scheduled. Some could not be held back, nor others advanced. As the sales manager said later, "Our program just sort of sprung a leak—oozed out—when everyone was wrapped up in vacations. I guess we haven't yet learned how much time counts."

The effectiveness of a special decision to raise or lower prices, for instance, or make salary adjustments, or open up new territories depends so much upon the choice of time. We are prone to thoroughly consider what we will do—then hastily decide when to do it.

A comparison of the achievement records of two competitive corporations about equal in size, facilities, and policies may at first reveal a wide difference that seems difficult to explain. Then, as we delve into each company's history, we find that the successful one has learned how best to time its major decisions. Some business leaders appear to have an uncanny power to make correct decisions. We say they have luck, vision, courage, and wisdom. This may be true, but one thing is certain—they can and do match decision with time!

Do you ever study the pace of your own sales department—your company? This is a trait vital to long-term achievement. Though most sales managers anxiously try to hasten the pace, there is often more and more lost motion by doing so. Even machines may be run too slow for efficiency and others too fast for safety and long life. Setting a wise pace and adhering to it bring a rewarding accomplishment.

LATEST DEVELOPMENTS IN

Shop

Clearing Press of Modular Design

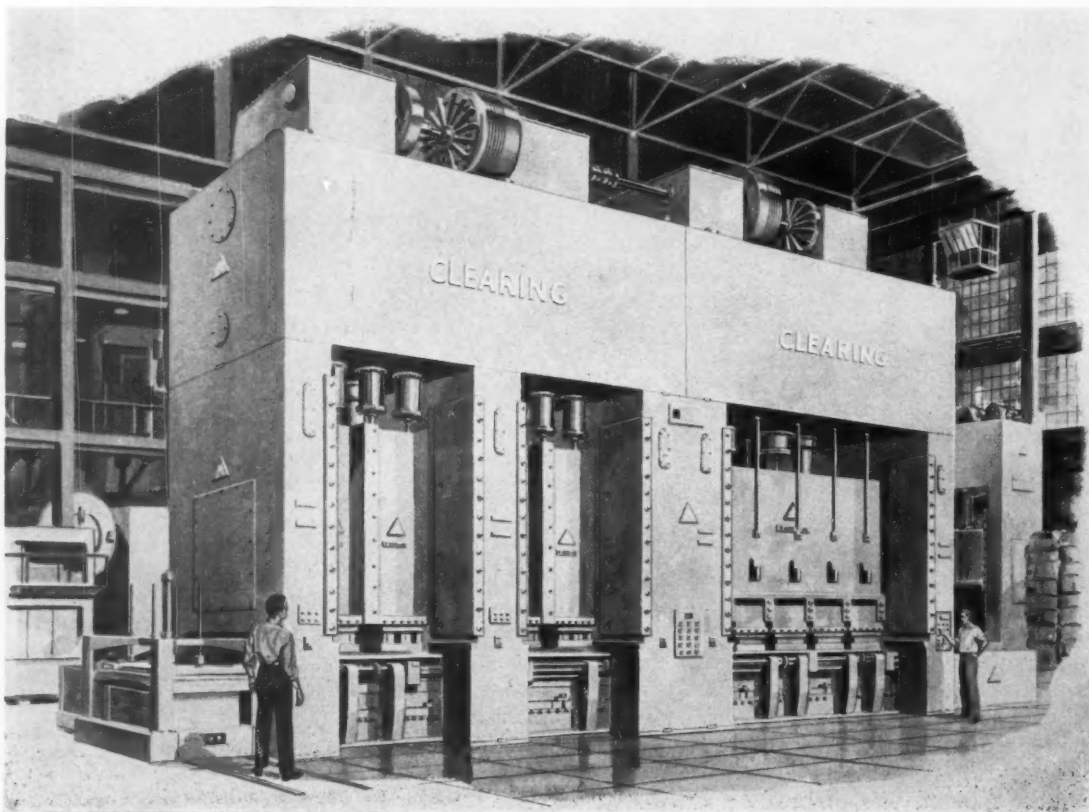
The Clearing Machine Corporation, division of U. S. Industries, Inc., Chicago, Ill., has introduced a new concept in press design which permits alteration of the physical characteristics of presses to provide for changes in manufacturing requirements. As production requirements must be modified to provide for major model changes, the modular Transflex equipment can also be modified to accommodate them, thus providing long-range obsolescence insurance.

The giant-size Transflex press shown in the accompanying illustration produces washer and dryer tops for the General Electric Co. This huge installation is 58 feet long and is equipped with twin drives, two crowns, and two beds that share common uprights. It has a transfer feed stroke of 50 inches and will produce over 700 stampings per hour. Designed for integrated production, the press produces washer tops for a period of four hours and is then converted to dryer top production for

a run of four hours, with only a ten-minute change-over period required. This quick change-over is facilitated by the split-slide construction on the first two stations. Punches not in use can be adjusted up and out of the way. In addition, several retractable sub-slides are mounted on the bottom of the large slide. These, too, can be adjusted rapidly during change-over. Micrometer shut-height indication is provided on all slides and sub-slides.

Circle Item 101 on postcard, page 275

Huge Clearing press installation that permits quick change-over to accommodate different parts



Equipment

Machine tools, unit mechanisms, machine parts, and material-handling appliances recently placed on market

Edited by FREEMAN C. DUSTON

Onsrud Mammoth Spar-Milling Machine with General Electric Electronic Control

A 90-ton universal spar-milling machine equipped to machine huge aluminum slabs into airplane parts has been announced by the Onsrud Machine Works, Inc., Chicago, Ill. Fig. 1 is a close-up view showing two of the four operator control panels and a pendant station—part of the control equipment used to direct the complex milling operations. Selsyn tracing

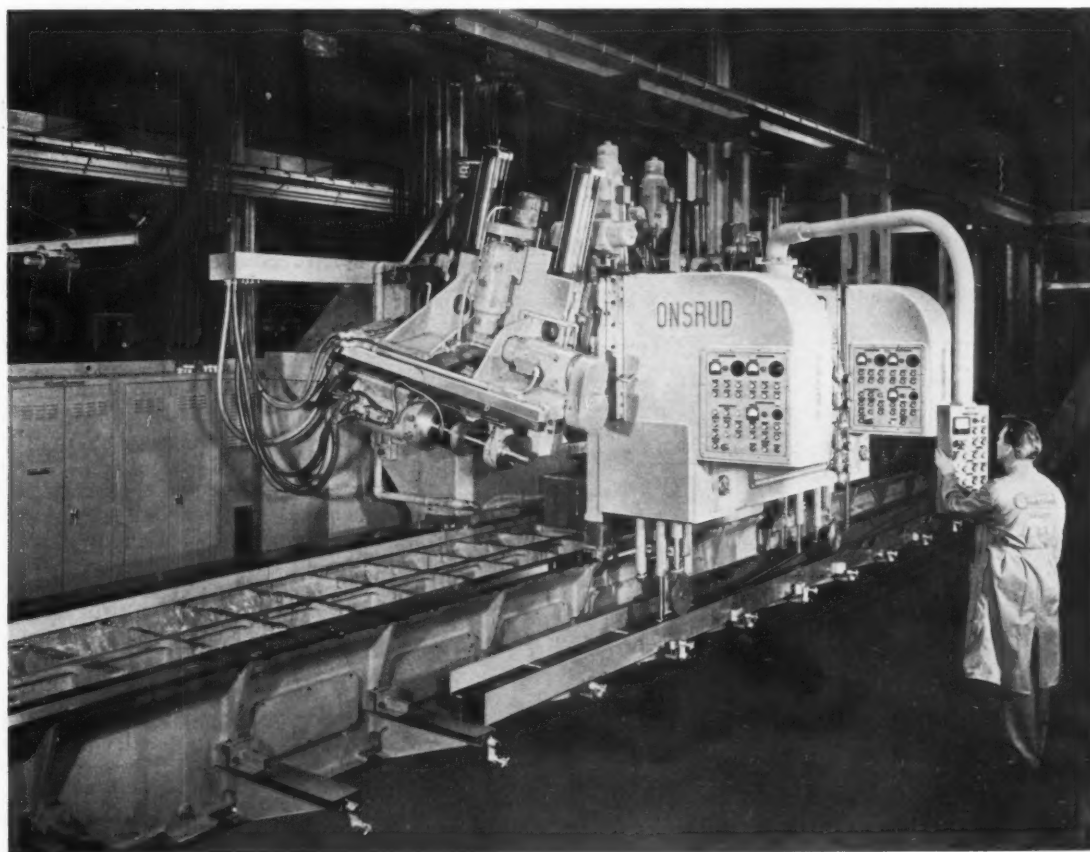
heads can be seen following the template, which is mounted parallel to the work-bed and located along the machine base.

This mammoth milling machine, the first of eighteen to be built by Onsrud for the United States Air Force Air Materiel Command, is equipped with a versatile, precision-engineered General Electric electronic tracer-control

system capable of directing, individually or simultaneously, from one to twelve cutter-feed motions. This control system is believed to be the largest and most flexible ever built. A block diagram representing the equipment for controlling one of the twelve feed motions is shown in Fig. 2.

In addition to the twelve Selsyn-controlled feed motions, there

Fig. 1. Close-up view of mammoth Onsrud spar-milling machine showing two of the four General Electric operator control panels and pendant control station



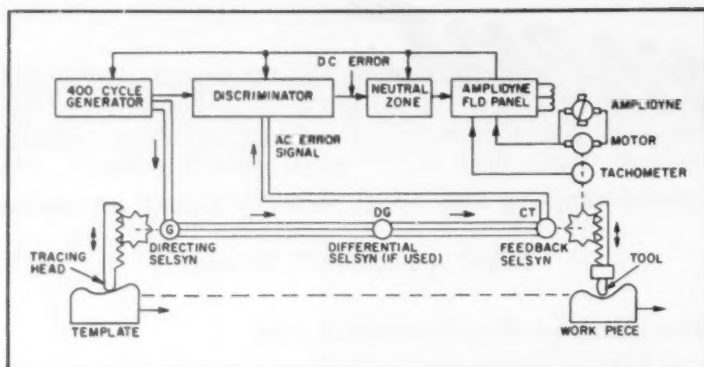


Fig. 2. Block diagram representing one of the twelve Selsyn tracer controls for feed motions on Onsrud spar-milling machine

is one 5-H.P. General Electric "Thymotrol" drive for the independent carriage-feed motion, as represented by the block diagram, Fig. 3. The machine relies upon thirty-eight electric motors, totaling 323 H.P., for its operation, and the equipment includes 7.4 miles of wire and cable. It will be employed in the manufacture of spar and wing chords and wing skins for use in aircraft ranging from high-speed interceptors to giant global bombers.

Early test results indicate that the machine is capable of taking repeat cuts to an accuracy of 0.002 inch at production speeds as high as 300 inches per minute carriage feed and 30 inches per minute head feed. The control is engineered to provide simultaneous rise and fall, transverse, and twist motions. For this reason, the machine is normally set up with

multi-purpose tooling fixtures which allow almost complete machining of a part before it leaves the stationary work-bed.

The machine is 84 feet long and will mill spar beams and parts up to 60 feet long. A gantry type carriage houses four cutter motors that together develop over 320 H.P. with an available total of twelve different feed motions, all under electronic tracer control. A cutter 16 inches in diameter mounted on a horizontal motor rotates at a peripheral speed of 170 miles per hour.

Circle Item 102 on postcard, page 275

Lincoln All-Position Pipe-Welding Electrode

The Lincoln Electric Co., Cleveland, Ohio, has introduced an electrode, designated Fleetweld 5-P, primarily designed for

pipe welding but suitable for all AWS E-6010 applications. Pipe welding, especially on the first or root pass with a "vertical upward movement" technique at low currents, demands exceptionally smooth arc operation, deep penetration, and good bead wash-in. In addition to having these characteristics, the new electrode is subject to minimum slag interference. This results in quick freezing or solidifying of the molten metal, and there is less tendency to form "windows" or cause porosity. The electrode produces a flat-shaped bead in an even deposit of metal from which slag is easily removed to obtain a clean weld.

Fleetweld 5-P can be used for welding pipe, pressure vessels, X-ray applications, and other ASME code work. It is suitable for all-position structural welding, machinery weldments, and ship welding. It has been approved by the American Bureau of Shipping and is available in 1/8- and 5/32-inch diameters.

Circle Item 103 on postcard, page 275

Lapmaster Lapping Machine

Additional and redesigned features have been incorporated in the Model 72 Lapmaster lapping machine of the Crane Packing Co., Chicago, Ill. The spider bar and roller bar attachments have been improved. An ammeter has been added as standard equipment. The spider bar is now a two-stanchion setup and ribbed on its under side to withstand all possible pressure the pneumatic cylinder can produce. This prevents binding in the guide ways when the pressure plate and conditioning rings are lifted.

Two adjustable supports have been added to the roller bar to keep it on an even plane so that it can be conveniently stacked with parts during loading or unloading of the machine. The ammeter warns against overloading, indicates how much pressure can be added from the pneumatic lift assembly, and also shows whether solenoids are operating properly. Capacity of the machine ranges from four 27-inch diameter parts

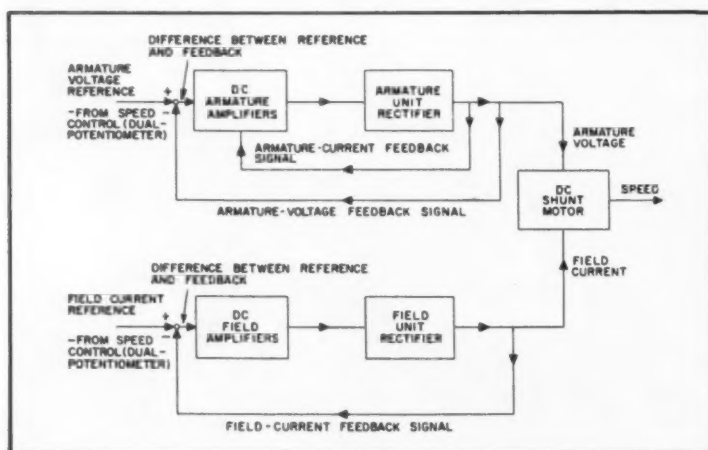
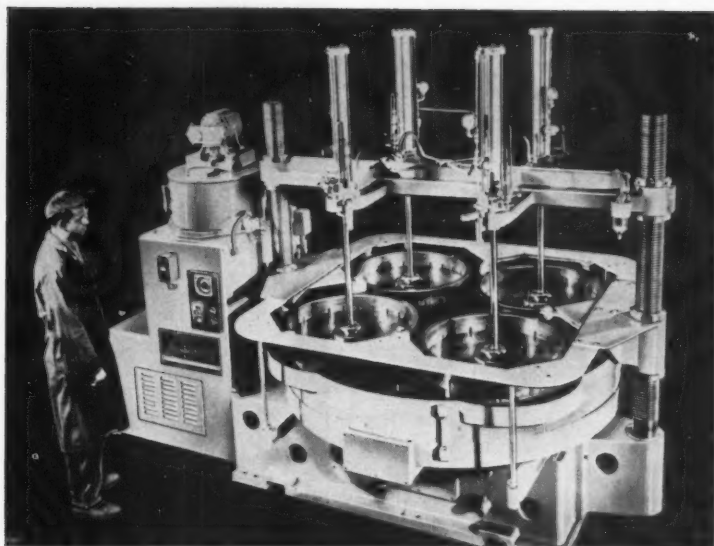


Fig. 3. Diagram of General Electric "Thymotrol" drive for independent carriage feed of Onsrud spar-milling machine



Crane Lapmaster machine with improved attachments

to 2480 1-inch diameter parts per load. It is capable of generating surface flatness to less than 1 light

band and surface finish to 2 micro-inches.

Circle Item 104 on postcard, page 275

Norton Cylindrical Grinding Machine

A cylindrical grinding machine designed to perform precision grinding operations on large, relatively lightweight work-pieces has been developed by the Norton Co., Worcester, Mass. This 30-inch Type LCTU semi-automatic cylindrical grinder is available in work lengths of 48, 72, and 96 inches and will handle work up to 30 inches in diameter.

Wide tables and ways are built into the machine to provide rugged support. Wheel-spindles run in long, pressure-lubricated bearings. Automatic or manual setting of the wheel feed is speeded up by means of a "click-count" wheel-feed index. With this device feed increments as fine as 0.0001 inch in work-diameter reduction are set without visual attention. The rotating, screw type automatic wheel-feed mechanism is designed to assure maximum repetitive accuracy.

The automatic cycle is started by operating a single lever and is terminated either manually or by an electrically timed control. A jogging lever permits fractional rotation of the work to the most convenient position for loading or inspection. Operation is also sim-

plified by a pre-set table-truing and grinding-speed control that permits maintenance of separate table speeds for truing and grinding as set from the first work-piece. It provides either speed immediately thereafter by short

movement of the table control lever. Constant resetting of table speeds is thus avoided. Work rotation start-stop and coolant flow cycle is controlled automatically with the grinding cycle or manually, as desired. A selector switch is provided for this purpose.

A wide variety of optional accessories for the machine increases its efficiency for special jobs. Locating devices, automatic wheel truing, automatic compensation of wheel-head setting after truing, and a lever-operated device which moves the grinding wheel into a shoulder to be ground are available as extra equipment.

Circle Item 105 on postcard, page 275

"Laboratory Grade" Carbide Inserts

Firth-Loach Metals, Inc., McKeesport, Pa., has added a new series of carbide inserts to its line of "laboratory grade" cemented carbides. Included in the new series are standard triangular and square throw-away inserts and Styles P and H inserts.

Stocked in both utility and precision-ground grades, the triangular throw-away inserts are available in six sizes and three grades. They are suitable for both general machining work and fine finishing.



Semi-automatic cylindrical grinder brought out by Norton Co.

The square throw-away inserts are carried in four sizes, from 3/8 by 1/8 inch to 3/4 by 3/16 inch. Three grades are stocked in both the utility grind (ground top and bottom only) and the precision grind

(ground on all surfaces). Styles P and H inserts are ground ready for use and are stocked in nine sizes and five grades to cover a variety of applications.

Circle Item 106 on postcard, page 275

Snyder Milling Machine Designed to Perform Five Complex Operations

A milling machine that performs five complex operations with minimum tool changes and part handling has been built by the Snyder Tool & Engineering Co., Detroit, Mich. Basically, this machine consists of a T-shaped, welded-steel base on which are mounted a rotary table 40 inches in diameter and a horizontal slide unit carrying a vertical spindle. Table speed, vertical cutter travel, and horizontal slide travel are controlled by stops mounted on the table periphery. Thus, it is possible to provide a variety of cutter locations, interrupt cuts, and change table speeds by suitable stop locations. Cutter speeds are adjusted to tachometer settings by a variable-speed drive. Tool changes are simplified by a quick-change, collet type holder. Tool setting gages are built into the work-fixture on the table.

The machine mills bosses and performs four blend-milling operations on a large magnesium aircraft jet-engine front bearing support. The cutter is automatically lifted or backed out to clear spokes or interrupt cuts in the various operations. Table speeds are automatically increased for rotation between milling cuts.

The five operations are performed with the part in two different loading positions, using three different milling cutters. A total of fifty minutes floor-to-floor time at 80 per cent efficiency is required.

This hydraulically operated, electrically controlled, special milling machine occupies a floor space about 9 by 13 feet. Hydraulic power is provided by a separate motor, pump, and tank unit.

Circle Item 107 on postcard, page 275



Snyder milling machine that performs five complex operations



Delta 20-inch drill press

Delta Drill Presses

The Rockwell Mfg. Co., Pittsburgh, Pa., has brought out a Delta 20-inch drill press which will be available in a wide range of models for drilling holes up to 1 inch in diameter in cast iron and 3/4 inch in steel. This drill press can easily be set up along the production line and, also, to operate in combination with other tools. Primarily, it is adapted for use in tool shops, maintenance departments, and model shops handling a variety of woodworking and metalworking jobs.

A Delta 15-inch drill press has also been introduced. This press is available in a wide range of models with six different spindle adapters. It is primarily a production-line tool for woodworking and metalworking, suitable for small commercial shops. Components of this press can be obtained for making up special-purpose equipment. It will drill holes 1/2 inch in diameter in cast iron and 3/8 inch in steel. Operations with adapters include counterboring, tapping, surface grinding, routing, mortising, plug-cutting, and wood-shaping.

Slow- and high-speed models offer a range of 470 to 4600 R.P.M. The drill press is powered

by a 1/3- or 1/2-H.P. motor. Spindle travel is 4 5/16 inches. The working surface of the production table is 12 by 18 inches.

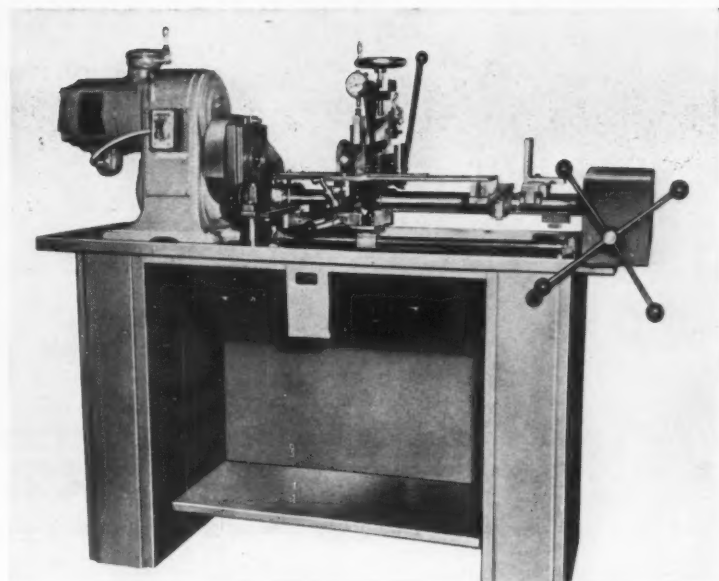
Circle Item 108 on postcard, page 275

Turnomat Centerless Turning Machine

A bar-turning machine that employs no centers, steadyrests, box-tools, or bushings was introduced at the recent Metals Show in Chicago by the Turnomat Co., Inc., Brockport, N. Y. This machine facilitates turning intricate shapes on bars of any length in one pass. It handles all grades of steel, copper, brass, aluminum, plastics, or wood from large bar stock sizes down to needle-point diameters. It is claimed that work-pieces can be precision turned to close tolerances (± 0.0005 inch) and fine micro-finish without tool chatter or tool marks.

A single-point cutting tool turns pieces to almost any contour or tracer shape, including straight 90-degree reverse and straight shoulder-to-shoulder work. With a two-position attachment, the machine will perform center-drilling, light-drilling, reaming, chamfering, and burring operations.

These centerless turning ma-



Centerless turning machine brought out by the Turnomat Co., Inc.

chines are built in three sizes—Models 1000, 1750, and 3500 to handle round bar stock up to 1 1/16, 1 3/4, and 3 1/2 inches in

diameter, respectively. Larger production models can be built to suit specific requirements.

Circle Item 109 on postcard, page 275

Abrasive-Belt Centerless and Surface Grinding Machines

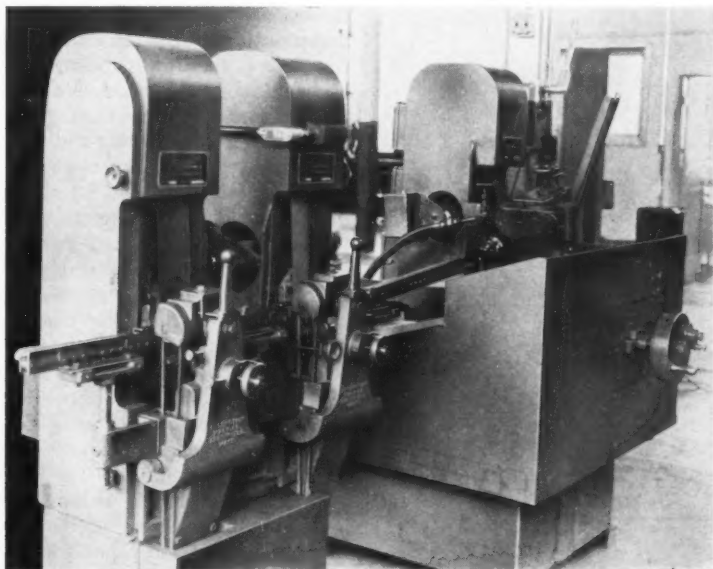
The Production Machine Co., Greenfield, Mass., demonstrated a Type 614 centerless grinding machine at the National Metals Ex-

position. This machine employs abrasive belts as cutting and feeding media. It handles long bars and tubes in sizes up to 4 inches in diameter, using power-driven fixtures. For heavy stock removal requiring several passes, a traverse-reversing device is used, which permits grinding the work-piece on both the forward and reverse-traverse strokes. This serves to reduce handling costs and production time.

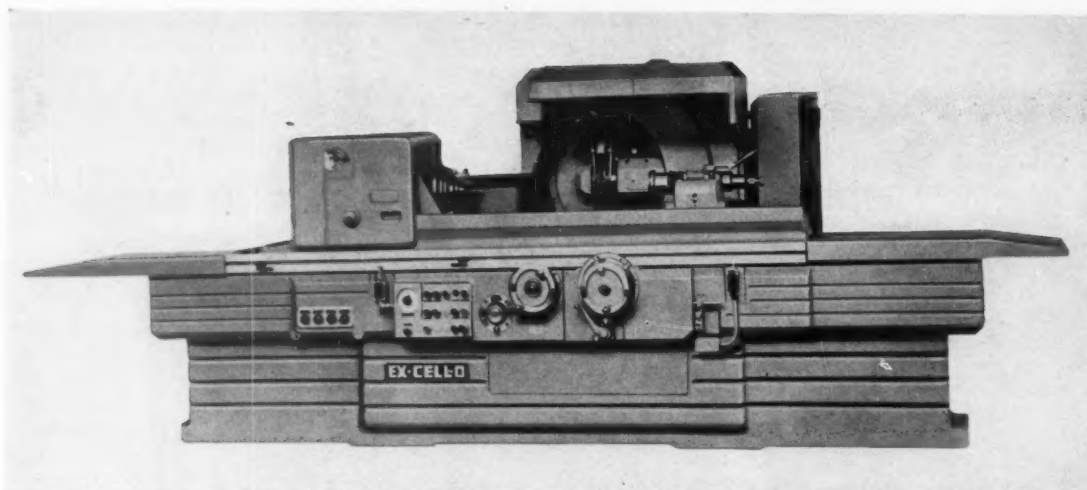
Another machine exhibited was a twin-belt surfacing machine with rotary feeding fixture. The latter machine grinds both ends of slug stock simultaneously at high production rates.

Two centerless machines connected in tandem, as shown in the accompanying illustration, were also demonstrated, showing a precision grinding operation and a two-pass finishing operation on cylindrical bar stock. These two machines operating as a duplex unit produce accurate work with a low micro-inch surface finish in a single handling.

Circle Item 110 on postcard, page 275



Duplex heavy-duty centerless polishing and finishing machine introduced by Production Machine Co.



Ex-Cell-O Style 36 precision thread grinder used for grinding threads in scientific instruments and testing devices

Ex-Cell-O Precision Thread Grinder

The Ex-Cell-O Corporation, Detroit, Mich., is now building seven styles of thread grinders, including external, internal, and universal types. These machines are adapted for grinding threads in precision parts for jet engines and airframes, scientific instruments, and similar work. They are especially suited for production of very accurate threads in parts made of titanium, stainless steel, and the new, hard alloys.

Lead-screws incorporated in

various actuating mechanisms are typical of precision parts with threads ground on these machines. For example, one of these machines was used to grind the thread on a lead-screw nearly 40 feet long with a diameter of 3 1/2

inches. This particular thread grinder is built to hold pitch diameters to plus or minus 0.0002 inch. Lead tolerances of plus or minus 0.0002 inch in any one inch, or plus or minus 0.0005 inch in any twelve inches, can be held on any standard thread form.

Circle Item 111 on postcard, page 275

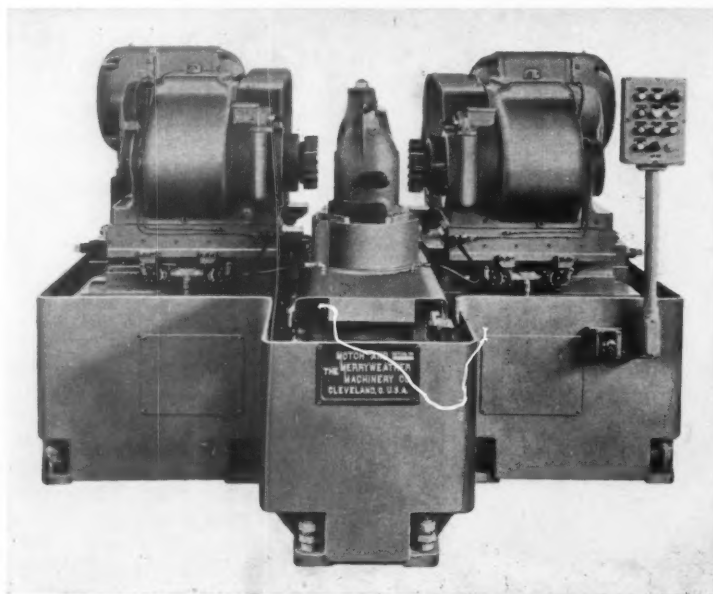
Duplex Machine Mills Two Sides of Housing at One Time

Two sides of transmission housings are milled simultaneously by opposed milling heads on a

rugged duplex machine built by the Motch & Merryweather Co., Cleveland, Ohio. The work is located on the large end surface through positioning holes. At the first pass, two bosses are milled on two sides, the lower bosses on each side being located close to the bottom edge of the casting.

For the second pass, and the milling of bearing surfaces on each side, the locating fixture is turned or indexed 90 degrees, and the work dropped about 1 inch so that projecting lugs are removed from the path of the cutters. In this second position, the cutters not only mill the bearing surfaces but also machine the top surfaces of the lugs. For this pass, the heads are advanced to bring the cutters into the correct positions for the milling cuts.

All movements are automatic, including the indexing of the table and fixture, the repositioning of the milling cutters, and the indexing of the table for milling the housing on the second pass. The



Motch & Merryweather duplex machine for milling transmission housings

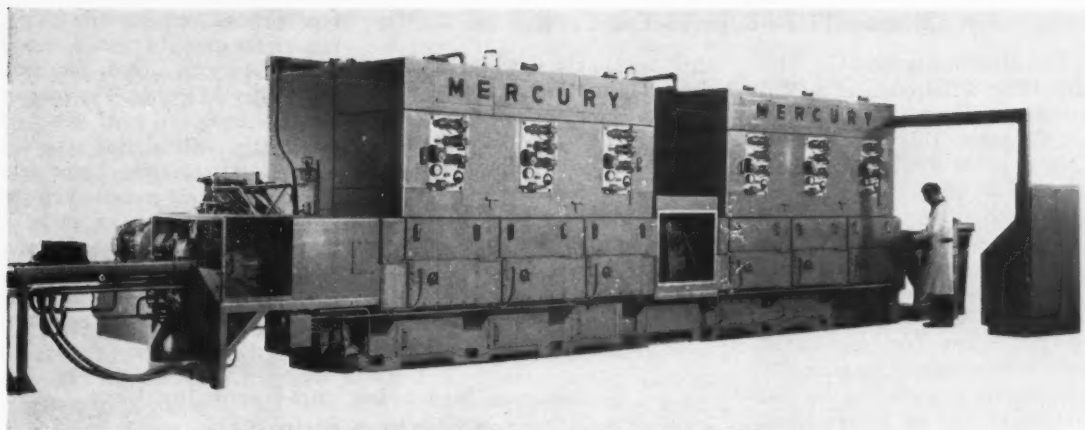


Fig. 1. Nine-station electrically controlled transfer machine for processing torque converter housings built by Mercury Engineering Corporation

milling heads are of the universal type with changeable speeds and with a 2-inch quill adjustment.

Mercury Nine-Station Transfer Type Grinding Machine

A nine-station transfer grinding machine brought out by Mercury Engineering Corporation, Milwaukee, Wis., for the Ford Motor Co., is equipped to grind the torque converter housings for either the Ford or Lincoln cars. This is said to be the largest transfer type grinding machine ever built. It is designed to be operated by one man positioned at the loading station.

The machine will grind both the front and rear mounting faces of 240 converter housings per hour at 100 per cent operating efficiency. It removes approximately 0.100 inch of stock from each face. The operating sequence is as follows: load part with bell end, or motor mounting face, in an upward position; rough-grind bell end of housing, removing all but approximately 0.060 inch of stock; semifinish-grind, leaving 0.015 to 0.020 inch of stock; finish-grind part to size; index part 180 degrees so that the transmission mounting face of the converter housing is in an upward position; rough-grind transmission mounting face of the casting, removing all but 0.060 inch of stock; semifinish-grind, leaving from 0.015 to 0.020 inch of stock; finish-grind to size; and unload part.

The machine is provided with

Machine movements are hydraulically actuated.

Circle Item 112 on postcard, page 275

automatic size control and automatic compensation for grinding-wheel wear. Air gages mounted directly at the loading station indicate the exact grinding condition at each of the six grinding stations. Dressing of the grinding wheels is also automatic and can

be adjusted so that the dresser passes across the wheel after a predetermined number of parts have been ground.

The electrical control panel, which controls all of the electrical functions of the machine, is about 30 feet long and is provided with a tracer panel equipped with tracer lights. The machine has an over-all length of 45 feet, height of approximately 10 feet, and weighs about 130,000 pounds.

Circle Item 113 on postcard, page 275

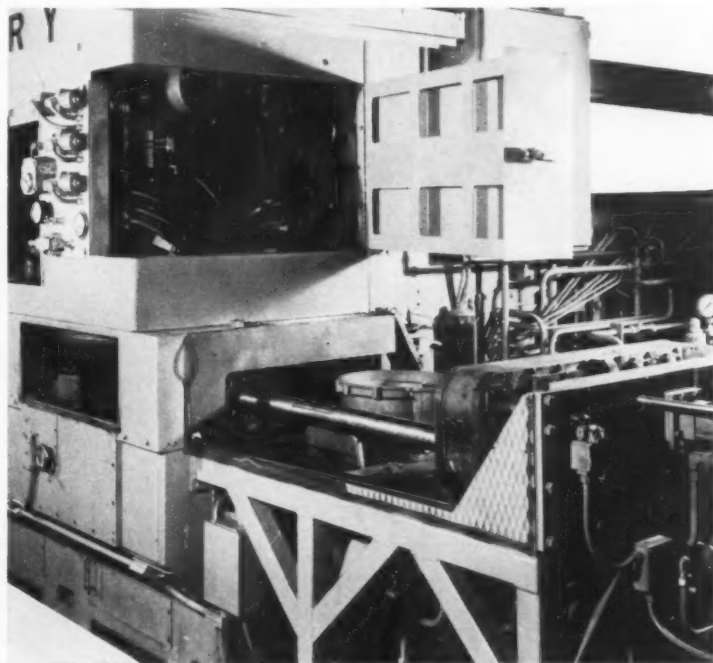


Fig. 2. Close-up view of loading station with casting in position

Minster Fixed-Base 75-Ton Press

The Minster Machine Co., Minster, Ohio, is introducing a fabricated-steel frame, fixed-base 75-ton G1 press. This press is available in either flywheel or geared types, with single-speed or variable-speed drive. It has a long flanged slide with barrel type adjustment and box type cast construction, designed to eliminate way deflection and insure slide-to-bed parallelism. The press is available with standard manual slide adjustment, as shown in the illustration, or with air power adjustment as extra equipment. The cover has been removed to show the position of slide and counterbalance. The two pneumatic counterbalances shown on the slide are standard equipment.

Lubrication is by a press-driven cyclic type automatic oil system. However, the Minster recirculating oil lubrication system is also available. Either the flywheel or geared type presses are equipped with the patented Minster combination air friction clutch and brake unit mounted on the crank-

shaft within the flywheel or main drive gear. On geared type presses, the gears are totally enclosed and run in oil. Centralized press controls for both clutch and drive are supplied.

The standard stroke of the press slide is 4 inches, and the maximum available stroke, 8 inches. A slide speed of 90 or 120 strokes per minute is standard for flywheel

type presses and 40 strokes per minute for geared types. The bed area is 24 by 36 inches, and slide area, 18 by 24 inches. The presses may be equipped with the bed attached or with sliding type die cushion. All controls, both electrical and air, are mounted on the press. The press is also made in the inclinable type. Other Minster Series G1 presses are built in capacities of 110, 150, and 200 tons.

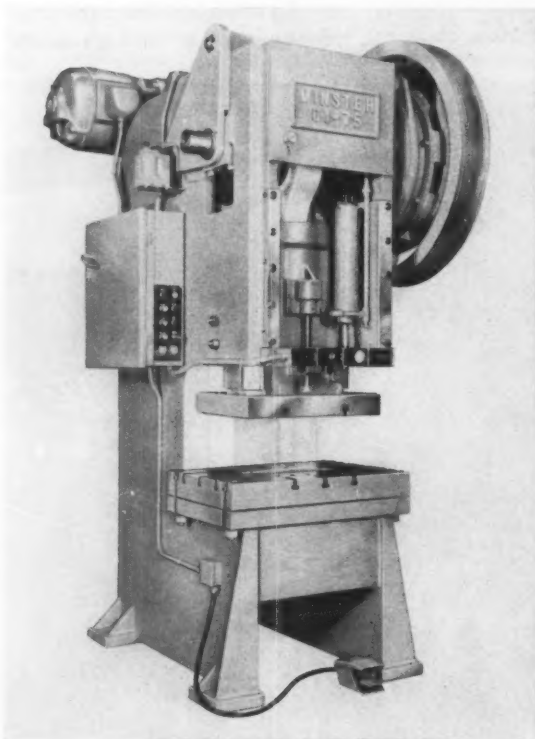
Circle Item 114 on postcard, page 275

Continuous Measuring and Recording Gage for Checking Strip Stock

Federal Products Corporation, Providence, R. I., has brought out a continuous measuring and recording gage for checking strip stock. This gage has been developed to assist punch press departments in solving problems encountered in the production of uniform-quality stampings from stock that varies in thickness. An excessive amount of checking with ordinary measuring instruments would be required to ascertain that stock being fed to the presses

is of uniform thickness within suitable limits or to show exactly how much each roll of strip stock varies in thickness. The portable continuous measuring-recording gage illustrated is designed to economically provide the data required to overcome these difficulties.

The gage shown here can be adjusted to measure stock from 0.015 to 0.100 inch thick and from 5 to 18 inches wide. The stock passes between two crowned roll-



Minster fixed-base 75-ton capacity press



Federal continuous strip stock measuring gage

ers on the gage, the bottom one being the reference contact, and the upper one, the sensitive or measuring contact. As the stock varies in thickness, the action of the sensitive contact is transferred to an electronic amplifier which moves the meter hand and the pen of the recorder.

This gage is made up of stock components for quick assembly. Other stock items can be added to the basic gage that will enable it to signal the operator with lights or sound signals when bad stock is going through or, as has been done in many cases, the gage can be equipped to trip a switch that will shut off the feeding mechanism when the stock is out of tolerance.

Circle Item 115 on postcard, page 275

De Laval Coolant Clarifier

A Model 115 grinding and honing coolant clarifier introduced by the De Laval Separator Co., Poughkeepsie, N. Y., uses centrifugal force to remove both free abrasive grains and metal particles from the fluid. The equipment requires 6 square feet of space, has a dirt-holding capacity of over 3

gallons, and handles all types of coolants. The illustration shows it in use with a Hydrohoner made

by the Micromatic Hone Corporation.

Circle Item 116 on postcard, page 275

Radial Drill with Ram Having Linear and Angular Adjustment

Positioning the drill head without distributing the work-piece is made possible by means of a combination of linear and angular ram movements on a new radial drilling machine brought out by the I. O. Johansson Co., Skokie, Ill. The ram is mounted on roller bearings to provide for sensitive linear positioning of the drill head. The tube column is adjustable vertically and can also be rotated 360 degrees around its axis, providing both vertical and angular positioning.

The 360-degree ram rotation permits the use of two work stations, one on the adjustable table in front of the machine and the other on the fixed platform at the rear of the machine. Large work-pieces are placed on the rear platform of the machine and smaller work-pieces on the 20- by 28-inch table. The drill head mounted on the ram can be brought up to within 5 inches of

the column or moved out to drill to the center of a 52-inch circle. Vertical movement of the column permits a maximum height of 53 inches from spindle nose to working surface and a minimum height of 3 1/2 inches.

Maximum power is transmitted through a geared drive, allowing use of drills up to 1 3/4 inches in diameter for cast iron. Any of eight spindle speeds, ranging from 104 to 1200 R.P.M., can be selected instantly while the machine is running by means of shift levers which actuate drive clutches. Gears are in constant mesh, eliminating any possibility of gear damage when changing speeds. The No. 4 Morse taper spindle has a travel of 6 inches.

A smaller machine, which has a drilling capacity of 1 1/4 inches, a No. 3 Morse taper, and a 5-inch spindle travel, is also available from the manufacturer.

Circle Item 117 on postcard, page 275



De Laval coolant clarifier set up on honing machine



Radial drill brought out by the I. O. Johansson Co.

Press Brake Designed for Punching Operations

The Steelweld Machinery Division of the Cleveland Crane & Engineering Co., Wickliffe, Ohio, is building press brakes designed to accommodate punching equipment. A machine of 400-ton capacity, recently completed, has a double-plate bed with a 3-inch wide slot to receive punching slugs. This machine has a bed 8 feet 4 inches long by 17 inches wide. It operates at a speed of thirty strokes per minute, but the stroke length is only 2 inches. Thus, the punch velocity is low and impact reduced, resulting in long punch life.

The clutch and brake are air-operated and designed for low inertia. Discs are made hollow at the center to take large volumes of cooling air. These features serve to assure cool operation.

Other features are the motor-driven ram adjustment for securing the desired shut-height; air-counterbalance for ram; automatic oilers for bearings; ball joints with replaceable bearings for the ram; rigid one-piece welded steel

frames; and throat depth of 18 inches. This machine is placed 14 inches below the floor to bring the top of the bed 28 inches above the floor level.

Control for two-man operation is provided by three push-buttons for each man. These buttons are mounted on the ram. Before the press can be set in motion, four

of the buttons must be depressed. This makes it necessary for both men to have their hands in safe positions when the press ram descends. One button in each of the three-button groups is for stopping, permitting either operator to quickly stop the press. One set of three buttons can be locked out of the control circuit when the machine is operated by one man.

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Automatic Feeder for Clinch Nuts

A standard rotary type hopper for automatically feeding clinch nuts has been introduced by Feedmatic-Detroit, Inc., Detroit, Mich. This feeder unit is available in two basic hopper sizes, 18 and 24 inches, equipped with either gravity or power feed. One or two tracks can be used on the 18-inch hopper, and four tracks can be used on the 24-inch hopper. The rated output per track ranges from 150 to 250 pieces per minute.

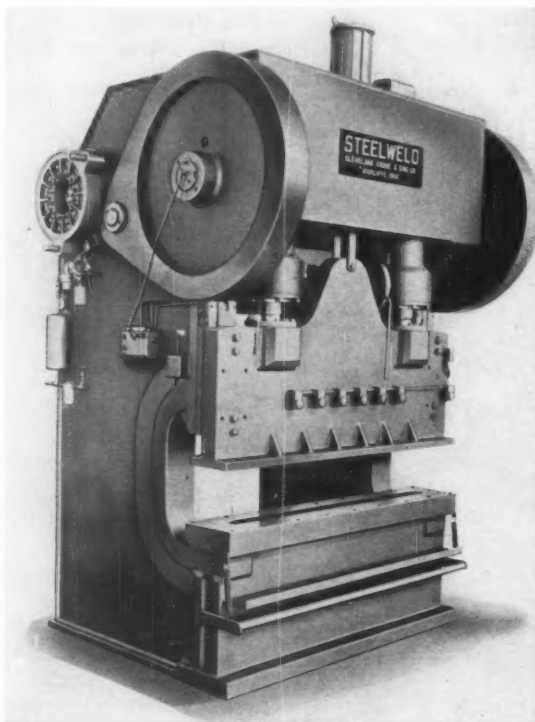
The feeding system operates on a fully enclosed, continuous-duty motor, equipped with a slip clutch

to take care of overloads. Gears are mounted on ball bearing shafts throughout, for heavy-duty service, and operate in an oil bath. The hopper has a three-point mounting for easy installation on rough or uneven surfaces.

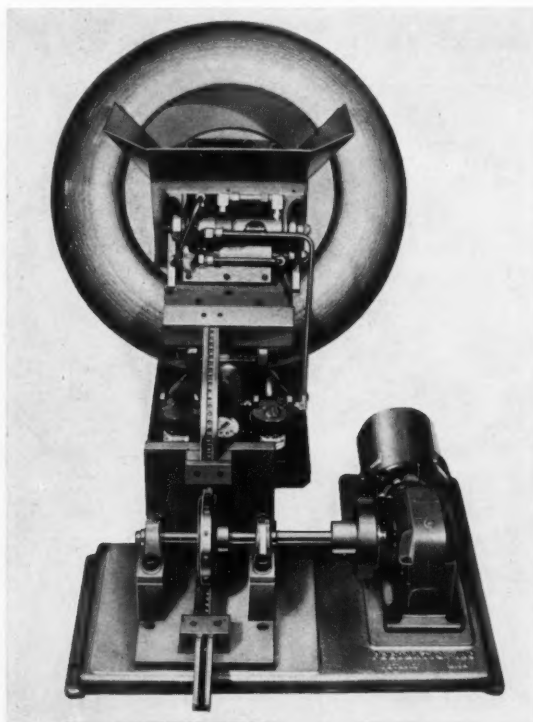
Circle Item 119 on postcard, page 275

Scanning Recorders for Strain Gages

Improved fifty-point automatic scanning recorders for SR-4 strain gages are announced by Bald-

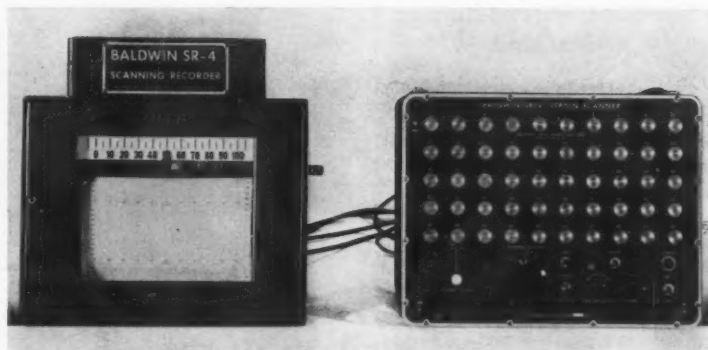


Steelweld press brake designed to include punching operations



Automatic clinch-nut feeder brought out by Feedmatic-Detroit, Inc.

win-Lima-Hamilton Corporation's Electronics and Instrumentation Division, Waltham, Mass. Either two-arm or four-arm strain gage bridges can be accommodated by proper positioning of a selector switch, and a fourth range of 0 to 1000 micro-inches has been added to ranges of 0 to 2000, 0 to 5000, and 0 to 10,000 micro-inches. In addition, individual stress-strain curves can now be plotted automatically for each channel, eliminating the plotting of points in order to analyze test results and permitting immediate information on possible structure failure while testing is in progress. To conserve chart paper when less than fifty channels are being scanned, a



Scanning recorder with switching and balancing unit

skipping mechanism has been provided for this equipment.

Circle Item 120 on postcard, page 275

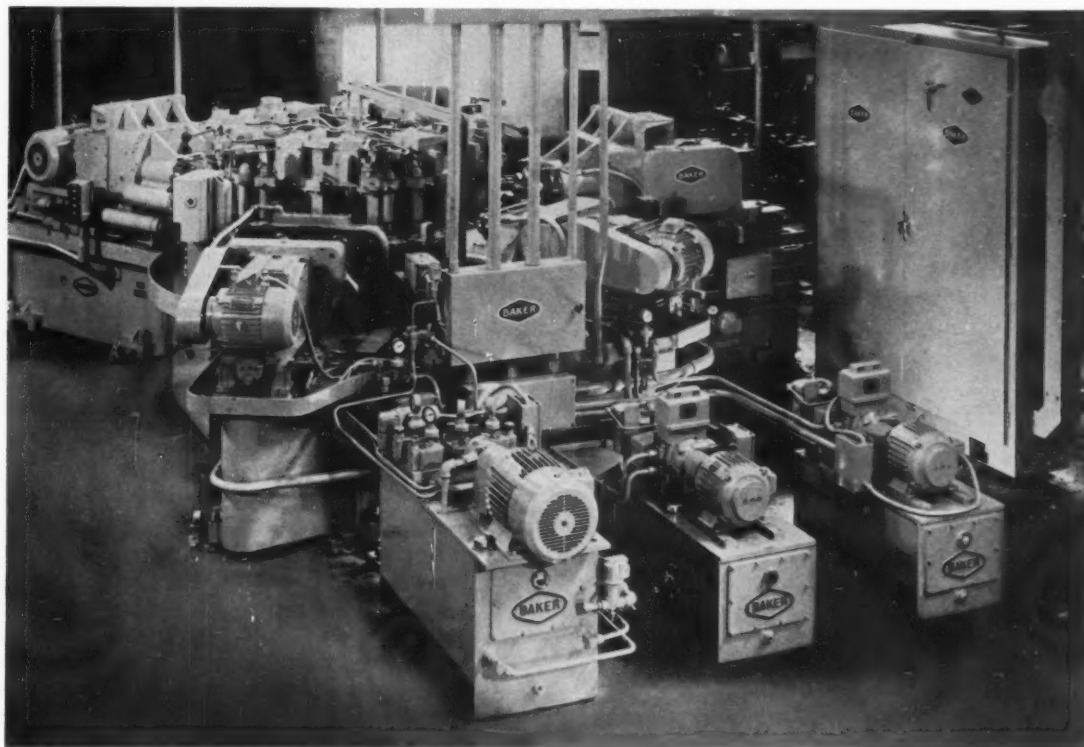
Baker Machine for Processing of Rock-Drill Parts

A multiple-operation indexing table machine has been built by Baker Brothers, Inc., Toledo, Ohio, for finishing parts which serve as brackets to hold cutting heads on oil-well rock drills. The machine consists of five stations in which the following operations

are performed: load two parts, center drill, drill, counterbore, ream, and recess. Each fixture holds two parts, and identical operations are performed on both parts at each station. The production rate is estimated to be about 120 parts per hour.

While specially designed to produce these rock-drill parts, this indexing type machine is composed of basic units which form a hydraulically operated standard machine that can be retooled for changes in product or production methods. For example, they can be used in multiple as furnished here, or employed singly. Consequently, these units make automation feasible even on lower production runs, as they are adaptable to change.

Circle Item 121 on postcard, page 275



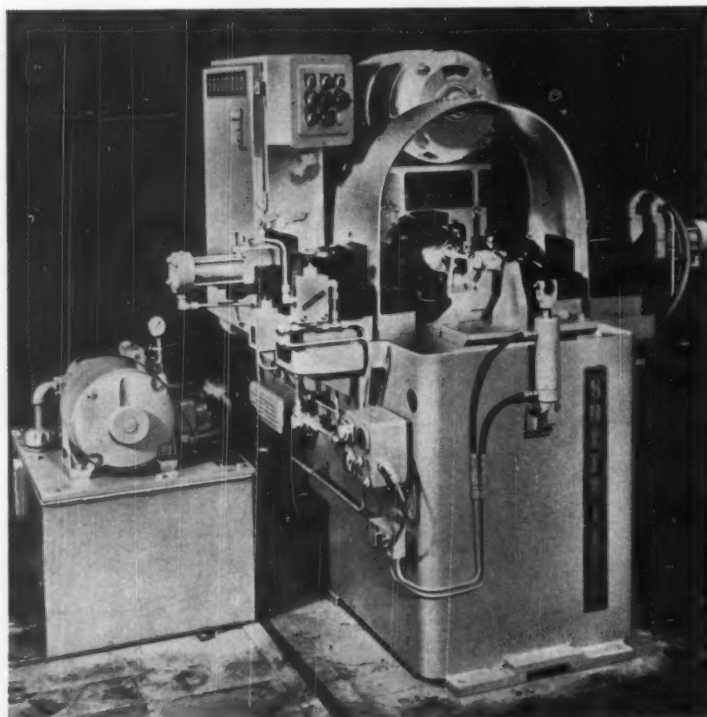
Baker Brothers five-station indexing machine for processing rock-drill parts

Sheffield Thread-Rolling Machine

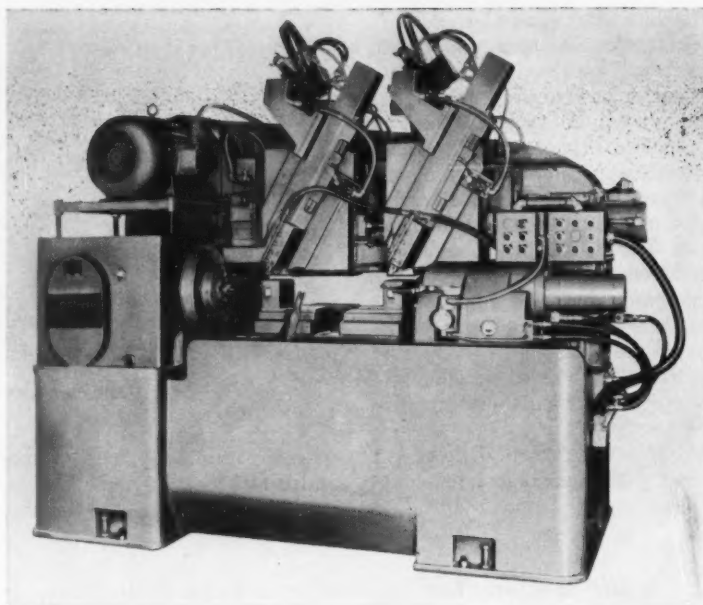
Both right- and left-hand threads can be rolled on bicycle cranks in a single automatic cycle on a Sheffield-Murchee machine at the rate of approximately 120 parts per hour, including loading and unloading time. Manufactured by the Sheffield Corporation, Dayton, Ohio, this machine consists of a floor type base on which are mounted two Precision-Rol units that are operated by a hydraulic sub-slide assembly.

The crank is loaded between centers and clamped in the work-holding fixture. Next, the operator pushes a button to actuate a special over-size Precision-Rol to roll the 15/16-24 right-hand thread. After the unit retracts, the standard No. 875 Precision-Rol attachment comes into position for rolling the 7/8-24 left-hand thread to complete the automatic cycle. The right-hand thread rolls are made extra-large to clear the driving lug on the bicycle crank. The machine is approximately 5 by 5 feet.

Circle Item 122 on postcard, page 275



Thread-rolling machine manufactured by the Sheffield Corporation



Lathe for combined rough- and finish-tracing

Hydra-Feed Double Tracer Lathe

Axle shafts, motor shafts, camshafts, and similar work—normally turned with multiple tooling requiring separate machines for roughing and finishing operations

—can now be handled in a single setup on double tracer lathes being introduced by the Hydra-Feed Machine Tool Corporation, Ferndale, Mich. In an original top arrangement, the two tracers can be mounted in a variety of combinations for optimum efficiency.

Greater accuracy and time savings are obtained, since the work does not have to be handled and chucked twice for separate roughing and finishing operations. Machining cycles are completely automatic and can be pre-selected for the particular operation.

Two different machining sequences are possible: traversing rear carriage operates first to perform multiple-tool roughing operations, after which the top carriage tracer slides move in for template controlled tracer-turning; or top carriage-mounted tracers perform their turning, after which the rear slides are used for form-tool grooving and under-cutting operations. Three basic sizes of double tracer lathes are available, with the swing over carriages being 11 1/2, 13, and 17 inches respectively. Length of parts that can be handled on standard machines is 24, 36, and 48 inches, for the three models.

Circle Item 123 on postcard, page 275

Mobile Parts Bank for Automated Production Lines

Shutting down an entire automated line for one disabled machine is eliminated by the addition of production stabilizing units recently developed by the Gear-O-Mation Division, Michigan Tool Co., East Detroit, Mich. These units, located between the production machines, become an integral part of the line and receive a floating and continuously moving bank of parts from the preceding machine and feed the parts, as needed, into the following machine. They consist essentially of zig-zag gravity feed tracks and parts elevators that can be used to insure continuity of production of any round part such as gears, screw-machine blanks, and similar parts.

The parts bank is designed to accommodate anywhere from several hundred to more than 5000 parts. In general, the bank size is selected to provide temporary storage and the release of a number of parts, the processing of which corresponds to the maximum time required to make tool

changes on the machine ahead of or following the unit.

Thus, tool changes or other adjustments can be made on any machine without causing interruption of production on any other machines in the integrated line. The tower which feeds the machine merely adds parts produced by the preceding machine to those in its floating bank. At the same time, the unit beyond the machine

releases parts previously "stored" in its floating bank to the next machine.

Parts that come into the storage tower are raised to the top of the cabinet by means of a roller-chain elevator that is powered by a "Cone-Drive" speed reducer. Pneumatically controlled escape-ments with electrical interlocks are used to handle the flow of parts from the storage tower to the succeeding operation.

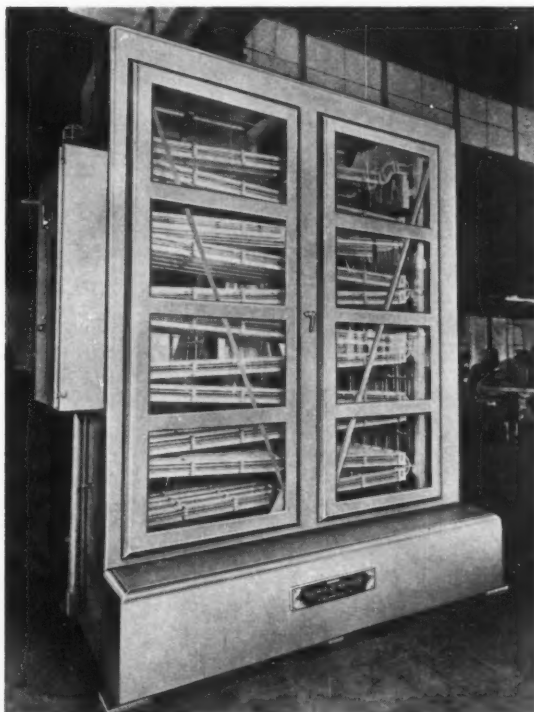
Circle Item 124 on postcard, page 275

Fully Automatic Pangborn Blastmaster Barrel Cleaning Unit

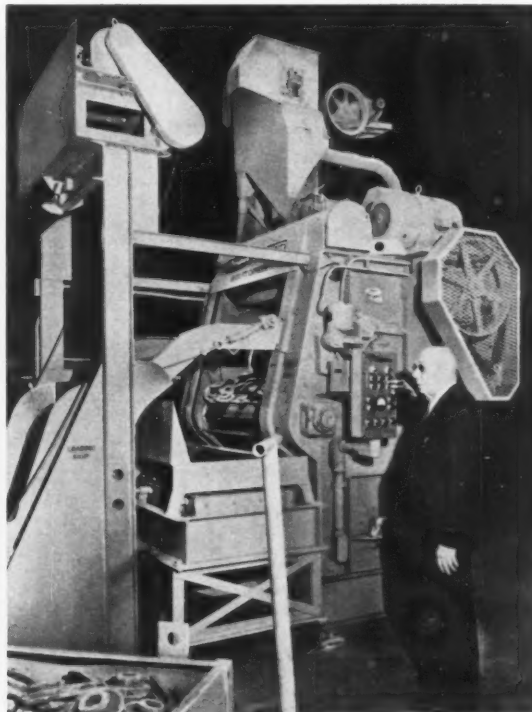
A fully automatic Blastmaster barrel cleaning unit has been brought out by the Pangborn Corporation, Hagerstown, Md. All operations, including material handling, weighing, and starting and stopping rotation of the barrel, are performed automatically. This equipment is designed for use in foundries, forge shops, heat-treating plants, and other metal-working factories which must clean and descale large quantities of parts.

In large-volume, high-production plants several automatic Blastmaster barrels can be grouped in a line to receive dirty castings from a conveyor that feeds each machine. After the cleaning cycle, one common conveyor serving all the barrels in the group takes the clean, descaled parts to the machines that perform succeeding operations.

All steps in the cycle are controlled automatically. However, the blasting cycle can easily be



Stabilizing tower built by Gear-O-Mation Division, Michigan Tool Co.



Blastmaster barrel cleaning unit equipped for automatic operation

changed to suit the cleaning time required for synchronization with the speed of the production line. A Blastmaster barrel of 12-cubic-foot capacity, having a Rotoblast wheel 19 1/2 inches in diameter with 3-inch throwing vanes, is shown in the accompanying illus-

tration. A 15-H.P. motor drives the wheel which can throw 24,000 pounds of shot per hour. A Pangborn CH-3 self-cleaning dust collector controls the dust created by cleaning. Barrel capacities are 6, 12, 18, and 27 cubic feet.

Circle Item 125 on postcard, page 275

Wales Printed Circuit Punching Machine

The Wales-Strippit Co., North Tonawanda, N. Y., has redesigned its Model 10-AA specialized fabricator press for punching printed circuit boards. Equipped with a "Positive Duplicator," an accessory that operates on the pantograph principle, this press will reproduce any pattern of holes within an area 15 by 25 inches from a master template. Round holes 0.030 inch to 3 1/2 inches in diameter and holes of any shape within an equivalent size range can be punched cold in most dielectric materials.

"Pilot-pin accuracy" is maintained between the template and work-piece by means of precision

ground locator-pins. The template is clamped in the "Positive Duplicator" when its reference holes are located on the template pins, and the work-piece is securely located by its reference holes on the pilot-pin work-holders.

As the duplicator stylus is moved to hole locations in the template, the pantograph carriage locates the work-piece in corresponding positions under the fabricator punch-holder. Pressing the stylus into a hole in the template electrically actuates the punching mechanism of the press. By reversing this process and using a pointed stylus in a pilot printed circuit located in the du-

plicator, the master template can be punched out in the desired pattern and a standard pilot-hole size of 1/8 inch. Other pilot-hole sizes can, of course, be similarly produced. Since the fabricator is a 20-ton press, steel templates up to 1/4 inch thick are easily punched.

Punching speed is largely a matter of operator dexterity, since the press ram reciprocates at the rate of 165 strokes per minute.

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Jiffy Metal Disintegrating Machine

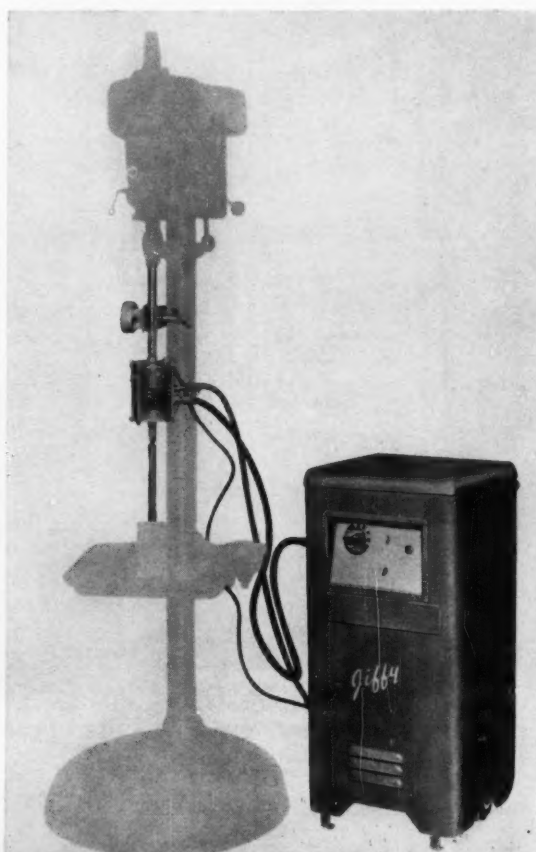
A Model B-1 metal disintegrating machine that features a self-contained cabinet wired for 110-, 220-, or 440-volt current and permits fast, efficient operation without the use of electronic tubes, rectifiers, or condensers has been announced by Jiffy Disintegrators, Inc., Royal Oak, Mich. This disintegrator is designed to quickly and completely remove broken taps and drills.

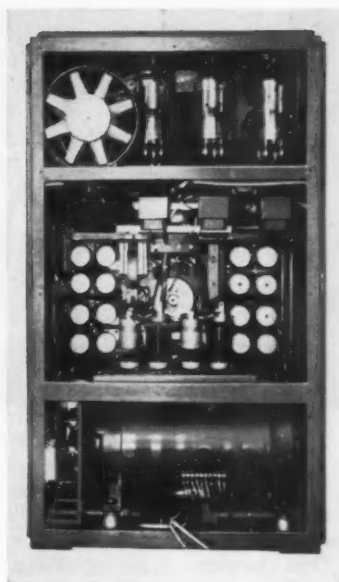
Circle Item 127 on postcard, page 275

Printed circuit punching machine announced by Wales-Strippit Co.



Metal disintegrating machine announced by Jiffy Disintegrators, Inc.





(Left) Abaco electronic erosion machine. (Right) Rear view of Abaco electronic erosion machine with cover removed

Electronic Erosion Machine

Abaco Industries, Inc., Elmhurst, L. I., N. Y., have built an electronic erosion machine which operates on a 20 per cent higher cycle than the previous model. This machine, Fig. 1, reproduces directly the shape and profile of a soft master electrode in carbide or an already hardened alloy through the use of a spark, with an accuracy of plus or minus 0.0015 inch, producing a 10 micro-inch finish.

The back of the erosion machine with the cover off is shown in Fig. 2. The rotating high-frequency motor-generator set is at the bottom of the machine. This 5-H.P. unit is fed three-phase, 220-volt current and generates high-frequency, single-phase current.

The front of the machine has an on-and-off switch, with or without excitation, a rate-of-work control knob, and a reference voltage that will establish the tool gap automatically. The servo head can be seen in Fig. 1, mounted on a Fray miller on which an oil-pan is fastened. (The oil serves to increase the electrical resistance to the passage of the spark.) The head comprises an electric servo motor

which holds the electrode constantly at an exact distance of 0.0015 to 0.015 inch from the work, as determined by prepared data.

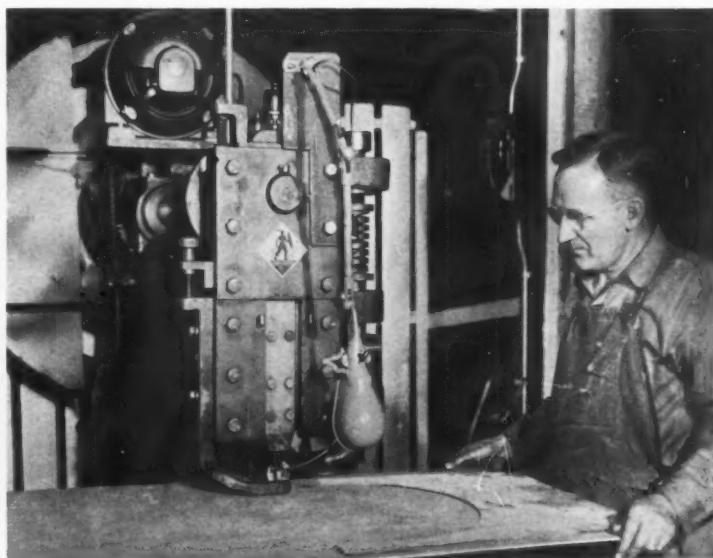
Circle Item 128 on postcard, page 275

Savage Nibbling Machines

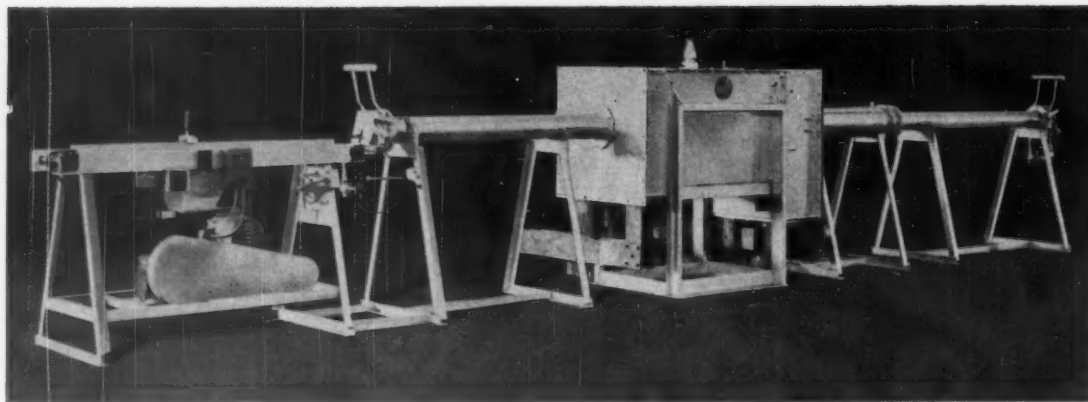
Nibbling machines designed for fast, accurate cutting of sheet metal are being built in two types and nine sizes by the W. J. Savage

Co., Knoxville, Tenn. These machines can be used for slotting and tube cutting, as well as for cutting sheet metal by template or to a scribed line.

Roller-die type nibbling machines like the one illustrated are made in three sizes having capacities for cutting mild steel or soft metal 1/4, 3/8, and 3/4 inch thick, respectively. The No. 3 machine shown is being used to cut alumi-



Cutting aluminum plate 1/4 inch thick on Savage nibbling machine



Continuous carbon-tube furnace manufactured by Harper Electric Furnace Corporation

num plate 1/4 inch thick. It has a throat depth of 36 inches and will cut mild steel up to 3/4 inch thick.

The nibbler type machines, built in six sizes, have throat depths ranging from 12 to 36 inches and capacities for cutting mild steel sheets ranging from 3/16 to 1/2 inch in thickness.

Circle Item 129 on postcard, page 275

Bridge Ram Milling Machine

A four-spindle bridge ram "Index Mill-Matic" milling machine has been developed by the Producto Machine Co., Bridgeport, Conn. It is used to mill the four pockets in the periphery of automotive transmission planet carriers. The spindles, individually powered, are carried by the bridge ram. This ram forms the main upper element of the machine and feeds hydraulically over the indexing dial on which are mounted the work-fixtures.

In operation, the ram traverses to the left, decelerates into feed to a positive stop, dwells, then returns to its starting position after tripping a limit switch.

There are eight work-fixtures spaced equally around the dial. Previous to each feed movement of the bridge ram, the dial indexes 45 degrees. Each fixture when indexed to a cutting position is directly in line with one of the spindles. Fixture clamps are hydraulically operated — tightened from a push-button and loosened automatically.

Circle Item 130 on postcard, page 275

Harper Carbon-Tube Furnace

Continuous tubular carbon-element furnaces with tubes having inside diameters up to 6 inches are available from the Harper Electric Furnace Corporation, Buffalo, N.Y. This type of furnace, which was first announced for high-temperature research, permits uniform heating of work within a tubular graphite resistance element in which temperatures up to 5000 degrees F. can be indefinitely maintained.

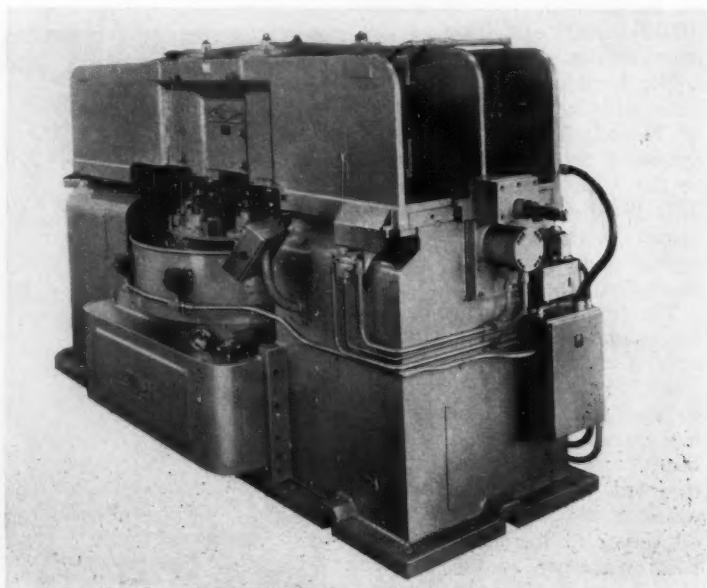
In addition to increased tube sizes, the furnaces feature continuous operation with an automatic mechanical pusher, an entrance preheating chamber, and a water-

cooled cooling chamber. Purge chambers may be added to maintain low dew-point reducing atmospheres. Quick-opening end compartments permit easy tube replacement. Over-all length of the largest unit is 28 feet. Research models with tube diameters as small as 1 inch are also available.

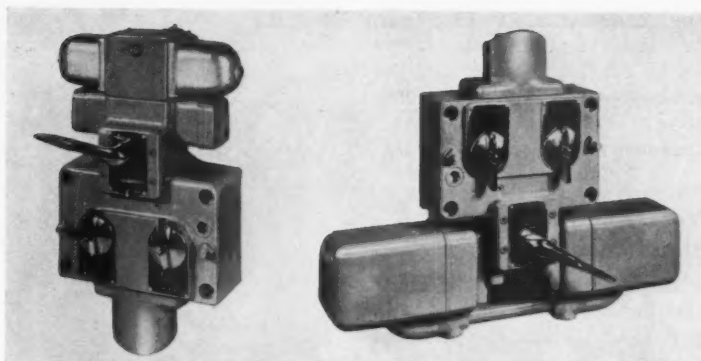
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Vickers Hydraulic Traverse and Feed Panels

Three new series of sub-plate mounted traverse and feed panels for the control of industrial oil-



Producto bridge ram "Index Mill-Matic"



Traverse and feed panels for industrial oil-hydraulic system control applications developed by Vickers Incorporated

hydraulic systems are available from Vickers Incorporated, Detroit, Mich. The panels are designed for application on a wide variety of machine tools and production equipment.

All three series—designated CPP, CPN, and CPD—feature improved valve sections for direction and feed control. Each is available in a broad selection of models. They are designed for use with 3/4-inch pipe size fittings at a maximum recommended operating pressure of 1000 pounds per square inch.

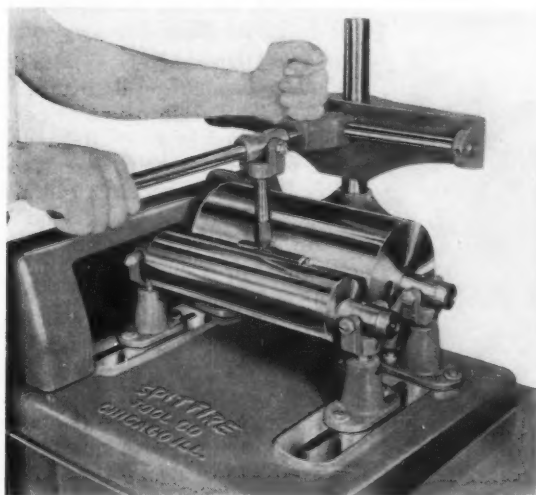
Either conventional or differential cylinder traverse action models are available. All models can be obtained in inverted designs. Either open or closed center main valve spools are available.

Two locking type dials permit independent selection of both fine and coarse feed rates. Adjustment of both rates is infinitely variable within the specified range and can be made during the feeding operation. Flow control is designed to assure a smooth and constantly maintained feed rate for any given adjustment, regardless of fluctuations in cutting tool resistance or changes in operating pressure.

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"Versa-Grip" Over-Arm Attachment for Spitfire Roller Lappers

The Spitfire Tool Co., Chicago, Ill., has developed a "Versa-Grip" over-arm attachment for use on its roller type lapping machines.



Spitfire roller lapping machine equipped with "Versa-Grip" over-arm attachment

This unit permits exacting control during lapping by holding the work down in contact with the lapping rolls. It is claimed that use of this attachment will minimize operator fatigue, speed up production, and give higher precision.

The unit can be easily attached to any Spitfire roller lapping machine now in use. It is designed on the fulcrum principle and enables an operator to use less effort in applying pressure on the work during the lapping operation and to apply the pressure precisely where it is needed.

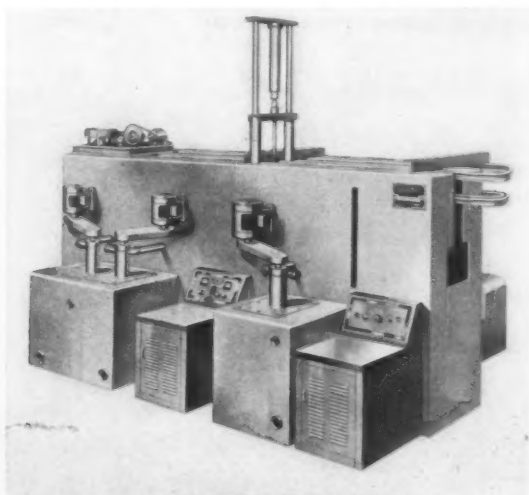
Two pressure blades are furnished with each attachment—a pin-point blade for removing tapers and ultra-precision lapping and an over-all blade that assures uniform pressure over parts up to 4 inches in length.

Circle Item 133 on postcard, page 275

Ransohoff Ultrasonic Cleaning System

Ransohoff, Inc., Hamilton, Ohio, has introduced a completely automatic, five-stage, monorail, ultrasonic cleaning system. Blind holes, recesses in castings that were difficult to reach, engine parts, stampings, valve bodies, and other parts from actual production lines may be thoroughly and rapidly cleaned.

The machine combines a single



Automatic, five-stage, monorail, ultrasonic cleaning system made by Ransohoff, Inc.

Bendix ultrasonic cleaning unit in one stage with conventional wash, rinse, and dry sections. Parts are carried through the machine on an automatic indexing, double-monorail conveyor. Grease, lap-

ping compounds, cutting oils, abrasives, and other contaminants can be removed 99.5 to 100 per cent effectively in a matter of only a few seconds.

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Automatic Machine for Processing Both Ends of Rods or Tubes Simultaneously

Automatic double-end machines that perform either press-forming or metal-removing operations at high speed on both ends of rod or tubular parts from 1 foot to 24 feet long and up to 6 inches in diameter are now available from Walter P. Hill, Inc., Detroit, Mich. These machines have hydraulic-operated automatic magazine feeds and two hydraulic-powered motorized precision heads that can each develop up to 20 tons of thrust force. Production rates range from 300 to 5000 pieces per hour depending on the size of the work and the operations performed. By stopping rotation of the motorized heads, parts can be run through the magazine feed in conjunction with a length-adjustment control. Thus, the machine can be operated like a forming press that will expand, reduce, flare, or bead both ends of the parts simultaneously.

With the motorized heads turning, parts can also be fed with the magazine feed in conjunction with the length-adjustment control. In this arrangement, the machines will burr, chamfer, face, spin, drill, precision bore, or ream both ends

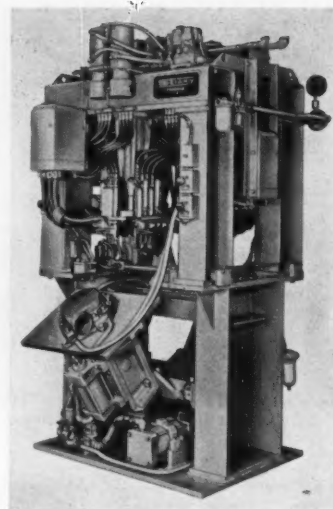
of the parts simultaneously. These operations can be combined with forming and finishing operations if desired.

Circle Item 135 on postcard, page 275

Multiple-Electrode Resistance Welder

A multiple-electrode spot-welding machine designed for air-hydraulic operation is announced by Sciaky Bros., Inc., Chicago, Ill. This SX-36-G welding machine consists of a universal multiple-gun base with two separate platen units. The platen units, operating independently, are loaded in the extended position, then swung in and raised to the welding position. After the welding operation is completed, the platens retract and swing out to permit unloading.

The standard base unit has been developed for easy attachment of special superstructures designed to support and locate transformers, welding guns, and hydropneumatic boosters to suit specific welding applications. Components can be rearranged to



Sciaky resistance welder

fit any other application within the capacity of the base unit.

The platen lift and retraction feature permits multiple spot-welding of deep-drawn sections. The in-and-out swinging facilitates loading and unloading. The welding control panels are made in accordance with JIC standards. The control operates on a 115-volt, 60-cycle, single-phase power supply. The operating sequence is initiated with two 24-volt, 60-cycle palm buttons. An emergency stop-button is provided for quick release of platen.

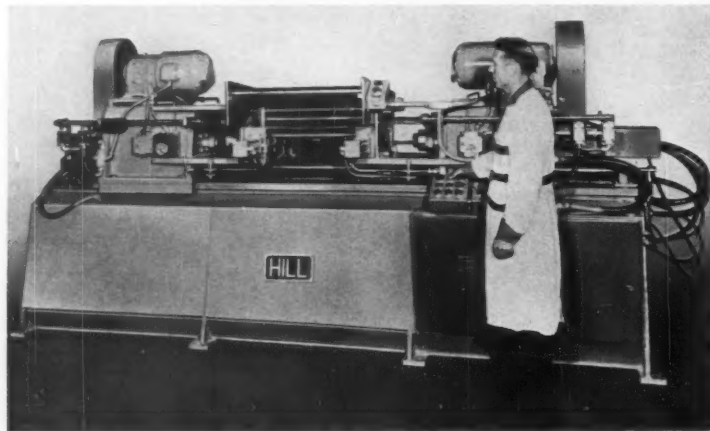
Circle Item 136 on postcard, page 275

"Scully-Drift" Cam Type Tool Ejector Available in New Sizes

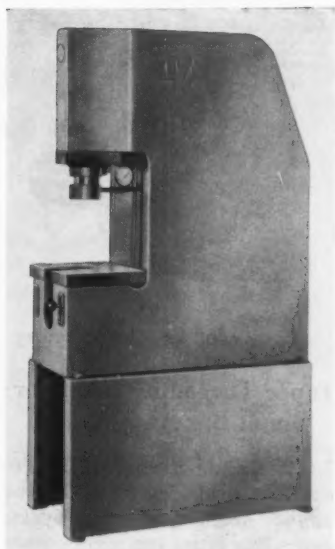
Scully-Jones & Co., Chicago, Ill., have announced that the "Scully-Drift" cam type tool ejector described in June 1956 number of MACHINERY, is now available in Morse taper sizes 1 and 4 in addition to taper sizes 2 and 3.

An important advantage of the Scully-Drift is that it can be used with one hand, permitting the operator to hold the tool with the other hand. This ejector has a cam-shaped profile on its bottom edge so that when it is inserted, at a slight angle to the center line, a mere twist of the wrist generates a powerful force against the tang of the tool and breaks it free from its locked position in the taper.

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Hill double-end rod and tube processing machine



Hydraulic power press announced by Northern Tool & Machine Co.

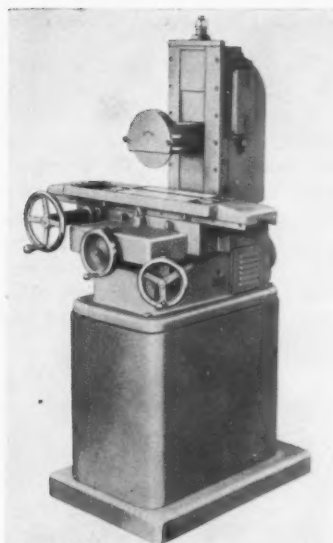
Hydraulic Power Presses

Two new models have been added to the 10- and 20-ton line of "Proven Power" hydraulic presses made by the Northern Tool & Machine Co., Melrose Park, Ill. These presses, having 7 1/2- and 15-ton capacities, are adapted for operations such as broaching, staking, forming, pressing, embossing, burnishing, assembling, drawing, crimping, trimming, bending, marking, straightening, punching, injecting, molding, stamping, and testing.

The ram is started by a slight movement of the control lever and can be slowed or stopped at any point in its travel for work inspection or test alignment. At the bottom of the stroke, the control lever is released, and the ram returns automatically to a pre-set stop. This stop may be set any distance from 1/4 inch to the full stroke of 12 inches.

The 7 1/2-ton model is available with a maximum closing speed of 265 inches per minute, maximum pressing speed of 240 inches per minute, and a maximum return speed of 400 inches per minute. The 15-ton model has a maximum closing speed of 270 inches per minute, pressing speed up to 120 inches, and a return speed of 345 inches per minute.

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"Excel" surface grinder brought out by the Covell Mfg. Co.

Covell Surface Grinder

A low-cost, precision, 6- by 12-inch, hand-feed surface grinder, designated the "Excel" No. 7A, has been announced by the Covell Mfg. Co., Benton Harbor, Mich. The elevating handwheel of this machine is located below the level of the table so that the graduations on the wheel and the point of grinding wheel contact with the work are where the operator can see both simultaneously. It also eliminates reaching overhead when lowering the grinding wheel. The floating dial pointer eliminates the need to add or

subtract when determining the amount of stock removed or to be removed.

A timing belt provides a smooth drive for the table. The lead-screws are made from a special long-wearing steel and have precision-ground threads. Hard chromium-plated table ways insure long-lived accuracy and eliminate the need for periodic rescrapping. A special plating process is used to apply a hard chromium surface to the vee and flat ways after they have been precision hand-scraped to a master plate.

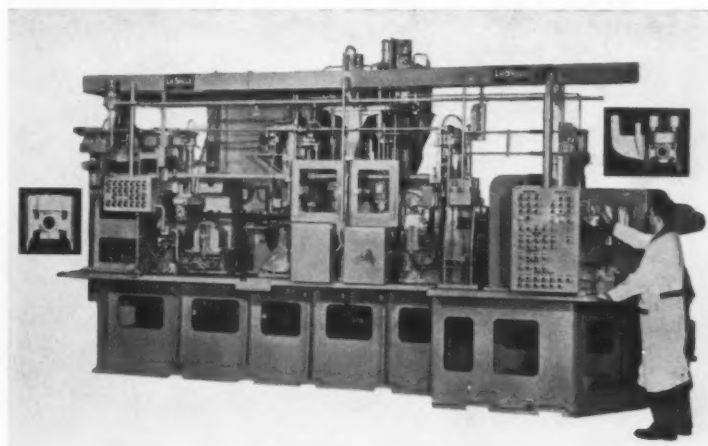
Circle Item 139 on postcard, page 275

LaSalle Dial and In-Line Machines Constitute Automated Piston Line

LaSalle Tool, Inc., Detroit, Mich., has combined a dial type machine and an in-line type machine to form a single unit. The complete piston line thus produced is a fully automatic unit with fourteen stations—five stations in the dial type section and nine stations in the in-line section.

This unit is designed to produce 400 pistons per hour and will handle, or process, any one of three different pistons merely by changing the position of the selector switch and fixture locators. It is built to JIC hydraulic and electrical standards, has automatic lubrication throughout, and a chip conveyor to handle pistons of different sizes and shapes.

Circle Item 140 on postcard, page 275



Automated piston processing unit built by LaSalle Tool, Inc.

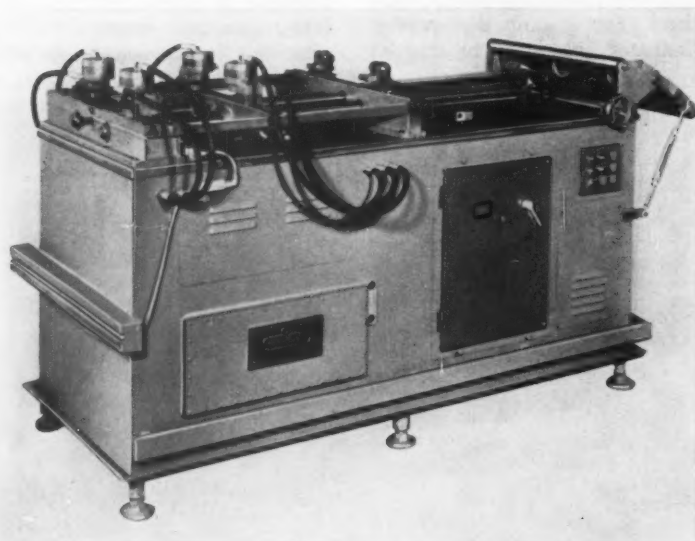
Ses-Matic Punch Press Feed

Special Engineering Service, Inc., Detroit, Mich., announces the addition of No. FC-3232 heavy-duty punch press feed to the Ses-Matic line of pressroom equipment. The hydraulically operated unit is equipped with a feed cylinder that has a 2 1/2-inch diameter bore, a 32-inch stroke, and is infinitely adjustable from 32 inches down to zero.

Operating under a hydraulic pressure of 500 pounds per square inch, a force of 2400 pounds pulls the stock through the feed. A pair of stock retainers hold the work with a force of 12,000 pounds while the grippers move back for the next stroke. Provision is made in the electrical control panel for cutting out the hydraulic retainers whenever desired. Mechanical stock retainers in the feed are mounted ahead of the grippers.

Timing of the feed with the press stroke is accomplished by means of a limit switch mounted on the press in such a manner that when the ram goes up, the limit switch is tripped and energizes the solenoid of a four-way valve. This causes the gripper heads of the feed unit to grip the stock and move forward on their feed stroke. When the limit switch breaks contact, the gripper heads release the stock.

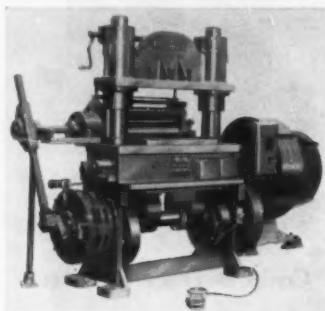
Circle Item 141 on postcard, page 275



Heavy-duty press feed made by Special Engineering Service, Inc.

Foil Stamping Press

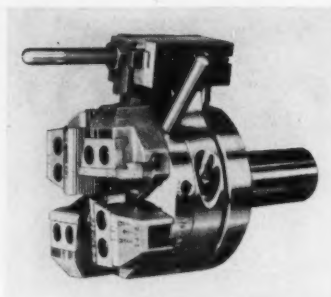
The Diamond Machine Tool Corporation, Pico, Calif., has brought out a Model 5024 Multi-Max punch press with design changes that make the machine suitable for large-quantity production of aluminum-foil containers. A roll feed is mounted on the bolster plate to feed aluminum-foil coil stock 24 inches wide. The roll feed has an advance adjustment from 0 to 14 inches. The



Multi-Max foil stamping press

press is of the single-gear type stroke and operates at a variable speed of from 60 to 125 strokes per minute. The working surface of the ram is 10 by 24 inches and that of the bed, 16 by 24 inches. The rated capacity of the press is 50 tons.

Circle Item 142 on postcard, page 275



Landis die-head for taper threading

Taper Threading Head for Small Bar Automatics

A 5C Landmatic stationary die-head has been developed by the Landis Machine Co., Waynesboro, Pa., for precision taper threading operations on No. 2 Brown & Sharpe and other small bar automatics. It has a 1/8- to 3/4-inch pipe-threading range and is equipped with an attachment which expands the chasers through a slide moving along a cam at a rate equal to the required taper as the die-head advances on the work-piece. Thus, cutting action is limited to the throat section and first full tooth of each chaser. Also, the attachment enables longer-than-normal taper thread lengths to be cut. No chaser leave-off marks are produced, and the threads meet dry-seal specifications.

A separate cam and cam-slide are required for each taper. However, they can be used for all diameters requiring that degree of taper. Maximum thread length is limited to the length of the cam-slide (3/4 inch), but shorter lengths can be cut by adjusting a stop-bar. Another feature is an adjustable spring mechanism which allows compensation of the cam lead of the machine for threads of different pitches. Through this device, the head can be adjusted for the correct amount of pressure necessary for the pitch of thread to be cut. External tripping of the head prevents its opening prematurely due to rapid turret indexing. One set of chasers can be used for all pipe diameters of the same pitch.

Circle Item 143 on postcard, page 275

(This section continued on page 252)

RUBBER-FLEX* COLLETS FOR B&S SCREW MACHINES

- Grip with far greater power than spring-type collets!
- Maintain a new high in concentricity!
- Protect the spindle unit!
- Cut inventories as much as 65%!

Here are collets with a grip you can trust—even on the heaviest cuts! In Rubber-Flex Collets, steel inserts permanently bonded to rubber hold the stock uniformly, firmly . . . actually *tighten* their grip as the power of the cut increases. They provide protection against slippage for all round stock jobs on Brown & Sharpe Nos. O and OG Automatics and the No. O Hand Screw Machine.

COLLETS WITH A SUPER GRIP!

The unique concentricity of Rubber-Flex Collets assures highest accuracy on the finest work. Run-out at the spindle nose is far less than with conventional equipment. What's more, collet faces seal flush against the chuck nut . . . protect the spindle unit from chip-laden coolant.

Rubber-Flex Collets eliminate the need for large inventories of individual sizes. Each collet has a range of 0.050". A set of only 13 covers the spindle capacity of any of the above machines from .100" to .750"! There's no need for "specials" . . . plenty of tolerance for over- or under-size stock. Write for full details and demonstration.

Brown & Sharpe Mfg. Co.,
Providence, R. I.

Buy Through Your Local Distributor

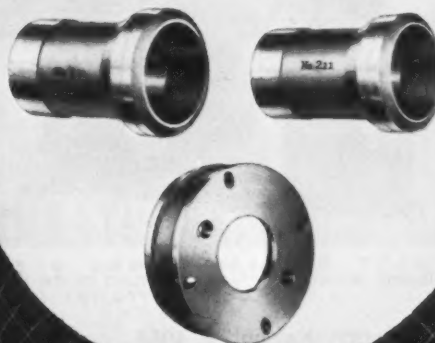
Brown & Sharpe

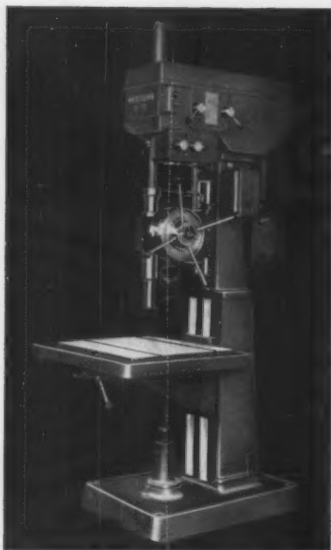
MILLING, GRINDING, AND SCREW MACHINES
• CUTTERS • MACHINE TOOL
ACCESSORIES • PRECISION TOOLS • PUMPS



*Rubber-Flex is a Trade-Mark of the Jacobs Manufacturing Company who makes these collets for us.

This set of two sleeves and one chuck nut handles all sizes of Rubber-Flex Collets. Set plus one collet costs no more than a special collet!





Western heavy-duty upright drilling machine

Western Drilling Machines

The Western Machine Tool Works, Holland, Mich., have brought out a line of precision drilling machines to supplement their No. 2-12 line. The new machines—designated Nos. 3-12, 4-12, and 5-12—have capacities for drilling holes 1 1/4, 1 1/2, and 1 3/4 inches in diameter, respectively, in cast iron. They are characterized by rugged construction, ample power, and extra-large table work surfaces. The machines are of ball-bearing construction throughout. Nine power feeds are

available, from 0.005 to 0.018 inch per revolution, which, combined with eighteen spindle speeds, provide a "hole producer" of extreme versatility.

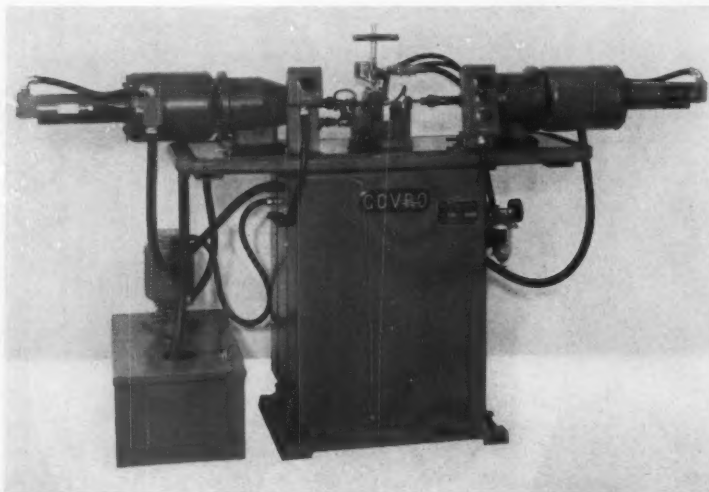
All transmission shafts and the spindle are mounted on precision ball bearings, and all speed and feed changes are made through hardened sliding gears on involute splined shafts, completely selective from adjacent instruction plates. All gears run in oil. Unit construction is used throughout. Available units include multiple heads, taper-drill combinations, and tapping attachments.

Circle Item 144 on postcard, page 275

Govro-Nelson Automatic Centering Machine

A machine designed to perform a centering operation on such parts as motor camshafts and crankshafts at a high production rate has recently been announced by the Govro-Nelson Co., Detroit, Mich.

The machine, which incorporates two opposed Govro-Nelson automatic drilling units, is simple to operate. The operator merely loads the part into a fixture and depresses the start cycle switches (one with each hand to insure safe operation), whereupon the work is automatically clamped, centered at both ends, and unclamped—ready for removal. The production rate is approximately 360



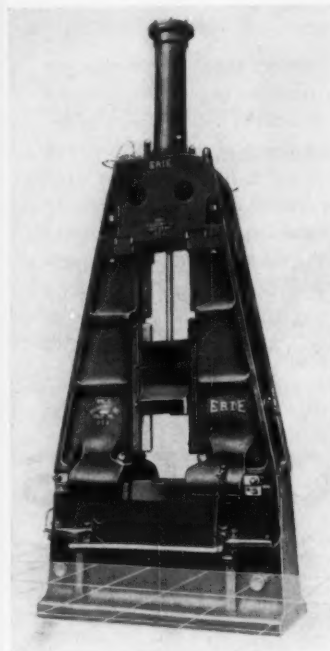
Double-end centering machine announced by the Govro-Nelson Co.

pieces per hour. By making minor changes, the machine can be readily adapted to a variety of parts.

Circle Item 145 on postcard, page 275

Erie Forging Hammer

A "Rigidrop" piston-lift gravity drop-forging hammer that is said to permit more blows per minute and more precise stroke control



Erie "Rigidrop" hammer

than ever before achieved is being introduced by the Erie Foundry Co., Erie, Pa. The all-steel, air-operated hammer affords complete control of stroke variation by varying the pressure on the treadle. Bearing surface of the ram has been increased 40 per cent, and adjustments to the guide ram are easily made from the front and back of the hammer, close to floor level. The ram can be removed at die level without jacking. Shop safety is promoted through the absence of loose linkage and overhanging parts.

Other features include a built-in inching mechanism for die set-ups and an improved clamping system. The hammer is available in sizes from 1500 through 5000 pounds.

Circle Item 146 on postcard, page 275

(This section continued on page 254)



THE YORK CORPORATION reports:
COST SAVING

23%

This Cincinnati Bickford Super Service Radial Drill effects substantial cost savings in general applications. Drilling, tapping and setting fifty $1\frac{1}{2}$ " diameter studs on this turbo casing, shown above, is done in 185 minutes now as against 242 previously.

The York Corporation tells us that simplified, centralized controls, ease of machine positioning and minimum operator fatigue are important factors in these cost savings.

*Write for bulletin covering these
Cincinnati Bickford Super Service Radials.*

Illustration courtesy of the York Corporation, York, Pa.

**CINCINNATI
BICKFORD**



RADIAL AND UPRIGHT DRILLING MACHINES

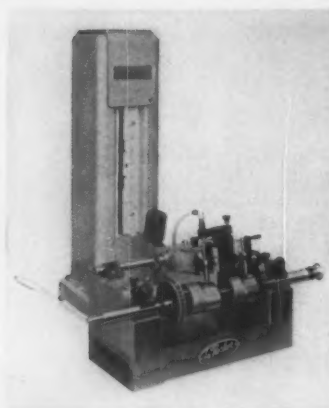
CINCINNATI BICKFORD DIVISION

GIDDINGS & LEWIS MACHINE TOOL COMPANY

OAKLEY, CINCINNATI 9, OHIO, U.S.A.

For more information fill in page number on Inquiry Card, on page 275

MACHINERY, November, 1956—253



Parker cam comparator

Two- and Three-Dimensional Cam Comparator

A comparator designed for rapid cam inspection has been announced by the Parker Stamp Works, Inc., Hartford, Conn. By checking against a master, this "3 D Comparitor" gives readings on both two- and three-dimensional cams that are accurate to tolerances of plus or minus 0.0002 inch, although measurements of plus or minus 0.0001 inch are possible on close precision work.

The comparator makes possible the complete, 100 per cent comparison of any two- or three-dimensional cam, giving true readings on an infinite number of specified points. It will also measure an infinite number of points between the specified ones.

This comparator is being used to check fifty to sixty cams per day which were inspected at the rate of only five or six cams per day by the conventional methods previously employed. Also, an intricate three-dimensional cam with 4000 stations, formerly demanding a full work-week for inspection, is now checked in less than four minutes on the new comparator.

A regular Sheffield air gage, with Plunjet, and a ball probe to trace the contours of the work are incorporated in the comparator design. The probe is made the same size as the cam follower to guarantee uniform precision. A counterbalance maintains constant micrometer pressure on the probe. The master and duplicate cam are mounted on a single arbor. As both pieces revolve, any discrepancy of dimensions is indicated on the air gage.

Circle Item 147 on postcard, page 275

Die Tryout Manipulator

Hamilton Tool Co., Hamilton, Ohio, has brought out a "Portelvator" for checking the fit of a punch and die. The equipment supports the punch on a top plate which can be rotated around a horizontal axis. For the tryout, the top plate is horizontal so that the punch is directly over the die and a pattern can be "pulled." Then, for any filing or polishing that is

indicated, the top plate can be rotated to a convenient vertical position. The punch is lowered and raised by a crank.

Circle Item 148 on postcard, page 275



Machine for testing thin metals

Ductility Tester for Thin Metals

Testing the ductility of very thin metals is the function of a Model D cup tester developed by Steel City Testing Machines, Inc., Detroit, Mich. The machine has been designed for testing many different types of metals including copper, brass, aluminum, tin plate, stainless steel, and carbon steel in thicknesses ranging from 0.003 to 0.062 inch.

It is a bench-mounted, hydraulically operated unit having two simple valves on the front of the base that provide infinite control of the testing operation. Depth of cup is shown by a dial indicator which is fitted with a friction brake so that maximum deflection readings are retained until released by the operator. Maximum load at the time of yield is shown by red "lazy" hand on load gage.

A standard 7/8-inch diameter ball penetrator and a standard 1-inch diameter die are supplied with the machine. Strips narrower than 2 inches can be tested by using special small-diameter penetrators. Such special penetrators, with matching dies and clamping plates are available at extra cost.

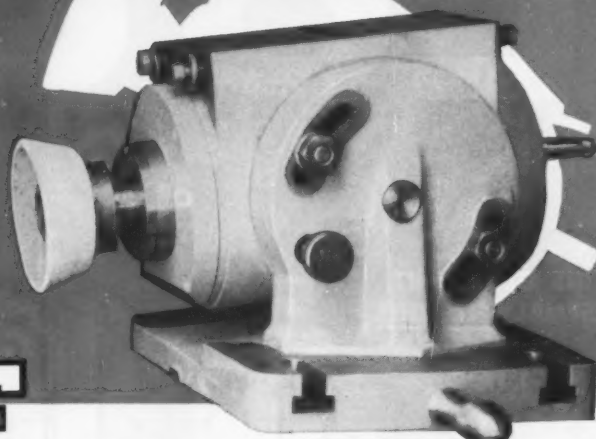
Circle Item 149 on postcard, page 275
(This section continued on page 260)



Hamilton Tool "Portelvator" for die tryout

HERE'S A HEAD THAT TILTS

*and Yours Will Nod, Too
When You See What
You Can Do With This
One*



POPE

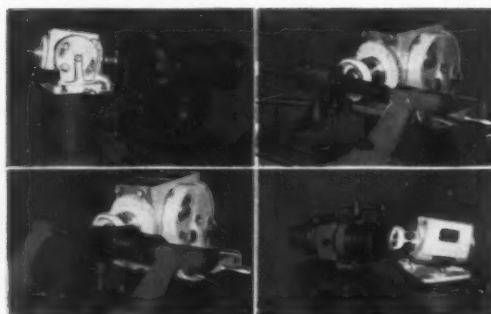
**SUPER PRECISION 1 HP,
3600 RPM MOTORIZED TOOL AND CUTTER GRINDER
CLEARANCE ANGLE SWIVELLING HEAD**

With Angular Adjustment In A Vertical Plane

Give this versatile head the nod and save time and money these seven ways:

1. You can use cup wheels for practically all clearance angles and thus produce a cutting edge on tools that lasts longer because it is stronger.
2. You can keep the tooth rest on the center line of the cutter for practically all grinding on centers or in the work head.
3. You can grind most cutters and reamers all over with a single set-up using the swivelling table and Pope tilting head.
4. You can read all clearance angles directly in degrees from the scale provided on the head. No more mistakes.
5. You can get the right clearance angle on such tough grinding jobs as slab mills, taper reamers, angular cutters and form tools.

6. You have one safe speed — 3600 RPM — for all wheels generally used on cutter grinders. Heat checking of cutters is virtually eliminated.
7. You have a head that's so easy to adjust and use it saves you time and money every time you grind a tool.



Ask us to submit complete specifications including price and delivery.

No. 101

Specify

POPE

PRECISION SPINDLES

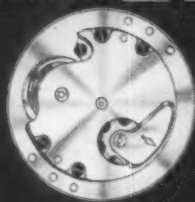
POPE MACHINERY CORPORATION

Established 1920

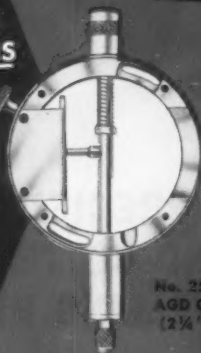
261 RIVER STREET • HAVERHILL, MASSACHUSETTS

LOOK

THIS GEAR UNIT
ASSEMBLY FITS THIS

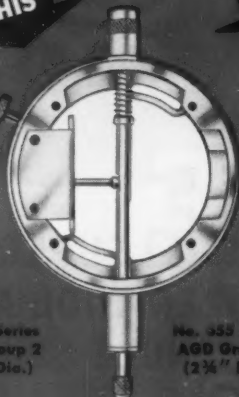


OR
THIS

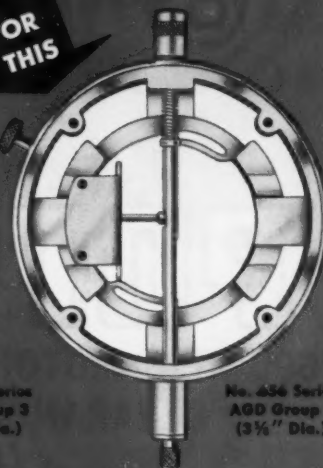


No. 25 Series
AGD Group 2
(2 1/4" Dia.)

OR
THIS



No. 655 Series
AGD Group 3
(2 1/4" Dia.)



No. 656 Series
AGD Group 4
(3 1/4" Dia.)

SIMPLE INTERCHANGEABLE DESIGN

Makes Starrett **HIGH PRECISION
LOW FRICTION** *Dial Indicators* *So Easy to Maintain*

(PATENTED)

If you use dial indicators — particularly if you maintain your own repair service — think what this exclusive Starrett feature means to you. Simple Interchangeable Construction means fewer parts to stock, less maintenance time and lower upkeep cost *plus* longer, more accurate life for all your dial indicators.

The entire gear assembly is identical and interchangeable in all comparable models of Starrett No. 25, No. 655 and No. 656 regular and Nonslock indicators. With only two different gear unit assemblies, and by merely changing the combination of gears, 105 different models can be made up with regular mechanism. By changing the case assembly to spindle and rack sleeve, most models can be converted to *Nonslock*.

Simple Interchangeable Construction also means fewer parts and these are heavier and more rigid. Rugged, rigid, simpli-

fied design means Starrett Dial Indicators are subject to far less friction and have a longer, more accurate life.

SEND THE COUPON for catalog describing the complete line of Starrett High Precision-Low Friction Dial Indicators.

The L. S. STARRETT COMPANY, Dept. D
Athol, Massachusetts

Please send information on Starrett *High Precision-Low Friction* Dial Indicators.

Name.....Title.....

Company.....

Street and Number.....

City.....Zone.....State.....

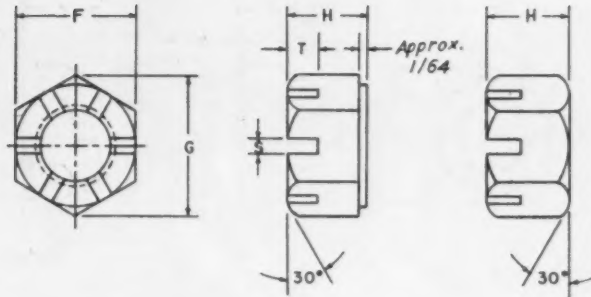
Starrett

SINCE 1880
WORLD'S GREATEST TOOLMAKERS



HAND MEASURING TOOLS AND PRECISION INSTRUMENTS
DIAL INDICATORS • STEEL TAPES • PRECISION GROUND FLAT STOCK
HACKSAWS • HOLE SAWS • BAND SAWS • BAND KNIVES

AMERICAN STANDARD FINISHED HEXAGON THICK SLOTTED NUTS



Nominal Size or Basic Major Diameter of Thread	Width Across Flats F			Width Across Corners G			Thickness H			Slot	
	Max. (Basic)	Min.		Max.	Min.		Nom.	Max.	Min.	Width S	Depth T
1/4 0.2500	7/16 0.4375	0.428		0.505	0.488		9/32	0.288	0.274	0.078	0.094
5/16 0.3125	1/2 0.5000	0.489		0.577	0.557		21/64	0.336	0.320	0.094	0.094
3/8 0.3750	9/16 0.5625	0.551		0.650	0.628		13/32	0.415	0.398	0.125	0.125
7/16 0.4375	11/16 0.6875	0.675		0.794	0.768		29/64	0.463	0.444	0.125	0.156
1/2 0.5000	3/4 0.7500	0.736		0.866	0.840		9/16	0.573	0.552	0.156	0.156
9/16 0.5625	7/8 0.8750	0.861		1.010	0.982		39/64	0.621	0.598	0.156	0.188
5/8 0.6250	15/16 0.9375	0.922		1.083	1.051		23/32	0.731	0.706	0.188	0.219
3/4 0.7500	1 1/8 1.1250	1.088		1.299	1.240		13/16	0.827	0.798	0.188	0.250
7/8 0.8750	1 5/16 1.3125	1.269		1.516	1.447		29/32	0.922	0.890	0.188	0.250
1 1.0000	1 1/2 1.5000	1.450		1.732	1.653	1	1	1.018	0.982	0.250	0.281
1 1/8 1.1250	1 11/16 1.6875	1.631		1.949	1.859	1	5/32	1.176	1.136	0.250	0.344
1 1/4 1.2500	1 7/8 1.8750	1.812		2.165	2.066	1	1/4	1.272	1.228	0.312	0.375
1 3/8 1.3750	2 1/16 2.0625	1.994		2.382	2.273	1	3/8	1.399	1.351	0.312	0.375
1 1/2 1.5000	2 1/4 2.2500	2.175		2.598	2.480	1	1/2	1.526	1.474	0.375	0.438

All dimensions given in inches.

BOLD TYPE indicates products unified dimensionally with British and Canadian standards.

"Finished" in the title refers to the quality of manufacture and the closeness of tolerance and does not indicate that surfaces are completely machined.

Taper of the sides of nuts (angle between one side and the axis) shall not exceed 2 degrees, the specified width across flats being the largest dimension.

Tops of nuts shall be flat and chamfered. Diameter of top circle shall be the maximum width across flats within a tolerance of minus 15 per cent for washer-faced nuts and within a tolerance of minus 5 per cent for double-chamfered nuts.

Bearing surface shall be washer-faced or with chamfered corners. Diameter of washer face and the diameter of circle of bearing surface of double-chamfered nuts shall be the maximum width across flats within a tolerance of minus 5 per cent.

Tapped hole shall be countersunk 1/64 inch over the major diameter of thread for nuts up to and including 1/2 inch, and countersunk 1/32 inch over the major diameter of thread for nuts over 1/2-inch size.

Bearing surface shall be at right angles to the axis of the threaded hole within a tolerance of 2 degrees for 5/8-inch nuts or smaller, and 1 degree for nuts larger than 5/8 inch; therefore, the maximum total run-out of bearing face would equal the tangent of specified angle times the distance across flats.

Slots may have square or round bottoms at option of manufacturer.

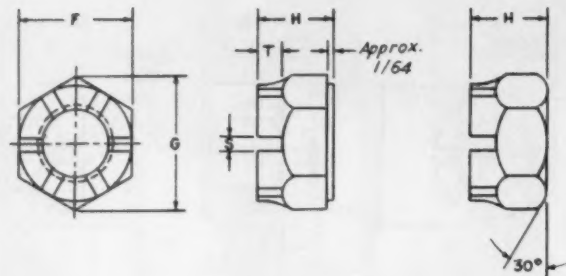
Thread shall be coarse- or fine-thread series, Class 2B.

Suitable material for steel nuts is covered by ASTM A-307; other materials will be as agreed upon by manufacturer and user.

Extracted from American Standard Square and Hexagon Bolts and Nuts (ASA B18.2-1955), with the permission of the publisher, the American Society of Mechanical Engineers, 29 W. 39th St., New York 18, N. Y.

MACHINERY'S DATA SHEET

AMERICAN STANDARD FINISHED HEXAGON CASTLE NUTS



Nominal Size or Basic Major Diameter of Thread	Width Across Flats F			Width Across Corners G			Thickness H			Nominal Height of Flats ³	Slot		Radius of Fillet ¹	Diam. of Cylindrical Part ²
	Max. (Basic)		Min.	Max.	Min.		Nom.	Max.	Min.		Width S	Depth T		
1/4 0.2500	7/16	0.4375	0.428	0.505	0.488		9/32	0.288	0.274	3/16	0.078	0.094	3/32	0.371
5/16 0.3125	1/2	0.5000	0.489	0.577	0.557		21/64	0.336	0.320	15/64	0.094	0.094	3/32	0.425
3/8 0.3750	9/16	0.5265	0.551	0.650	0.628		13/32	0.415	0.398	9/32	0.125	0.125	3/32	0.478
7/16 0.4375	11/16	0.6875	0.675	0.794	0.768		29/64	0.463	0.444	19/64	0.125	0.156	3/32	0.582
1/2 0.5000	3/4	0.7500	0.736	0.866	0.840		9/16	0.573	0.552	13/32	0.156	0.156	1/8	0.637
9/16 0.5625	7/8	0.8750	0.861	1.010	0.982		39/64	0.621	0.598	27/64	0.156	0.188	5/32	0.744
5/8 0.6250	15/16	0.9375	0.922	1.083	1.051		23/32	0.731	0.706	1/2	0.188	0.219	5/32	0.797
3/4 0.7500	1 1/8	1.1250	1.088	1.299	1.240		13/16	0.827	0.798	9/16	0.188	0.250	3/16	0.941
7/8 0.8750	1 5/16	1.3125	1.269	1.516	1.447		29/32	0.922	0.890	21/32	0.188	0.250	3/16	1.097
1 1.0000	1 1/2	1.5000	1.450	1.732	1.653	1		1.018	0.982	23/32	0.250	0.281	3/16	1.254
1 1/8 1.1250	1 11/16	1.6875	1.631	1.949	1.859	1	5/32	1.176	1.136	13/16	0.250	0.344	1/4	1.411
1 1/4 1.2500	1 7/8	1.8750	1.812	2.165	2.066	1	1/4	1.272	1.228	7/8	0.312	0.375	1/4	1.570
1 3/8 1.3750	2 1/16	2.0625	1.994	2.382	2.273	1	3/8	1.399	1.351	1	0.312	0.375	1/4	1.726
1 1/2 1.5000	2 1/4	2.2500	2.175	2.598	2.480	1	1/2	1.526	1.474	1 1/16	0.375	0.438	1/4	1.881

All dimensions given in inches.

"Finished" in the title refers to the quality of manufacture and the closeness of tolerance and does not indicate that surfaces are completely machined.

Taper of the sides of nuts (angle between one side and the axis) shall not exceed 2 degrees, the specified width across flats being the largest dimension.

Bearing surface shall be washer-faced or with chamfered corners. Diameter of washer face and the diameter of circle of bearing surface of chamfered nuts shall be the maximum width across flats within a tolerance of minus 5 per cent. Tapped hole shall be countersunk 1/64 inch over the major diameter of thread for nuts up to and including 1/2 inch, and countersunk 1/32 inch over the major diameter of thread for nuts over 1/2-inch size.

Bearing surface shall be at right angles to the axis of the

threaded hole within a tolerance of 2 degrees for 5/8-inch nuts or smaller, and 1 degree for nuts larger than 5/8 inch; therefore, the maximum total run-out of bearing face would equal the tangent of specified angle times the distance across flats.

Slots may have square or round bottoms at option of manufacturer.

¹ Tolerance on the fillet radius is plus or minus 0.010 inch.

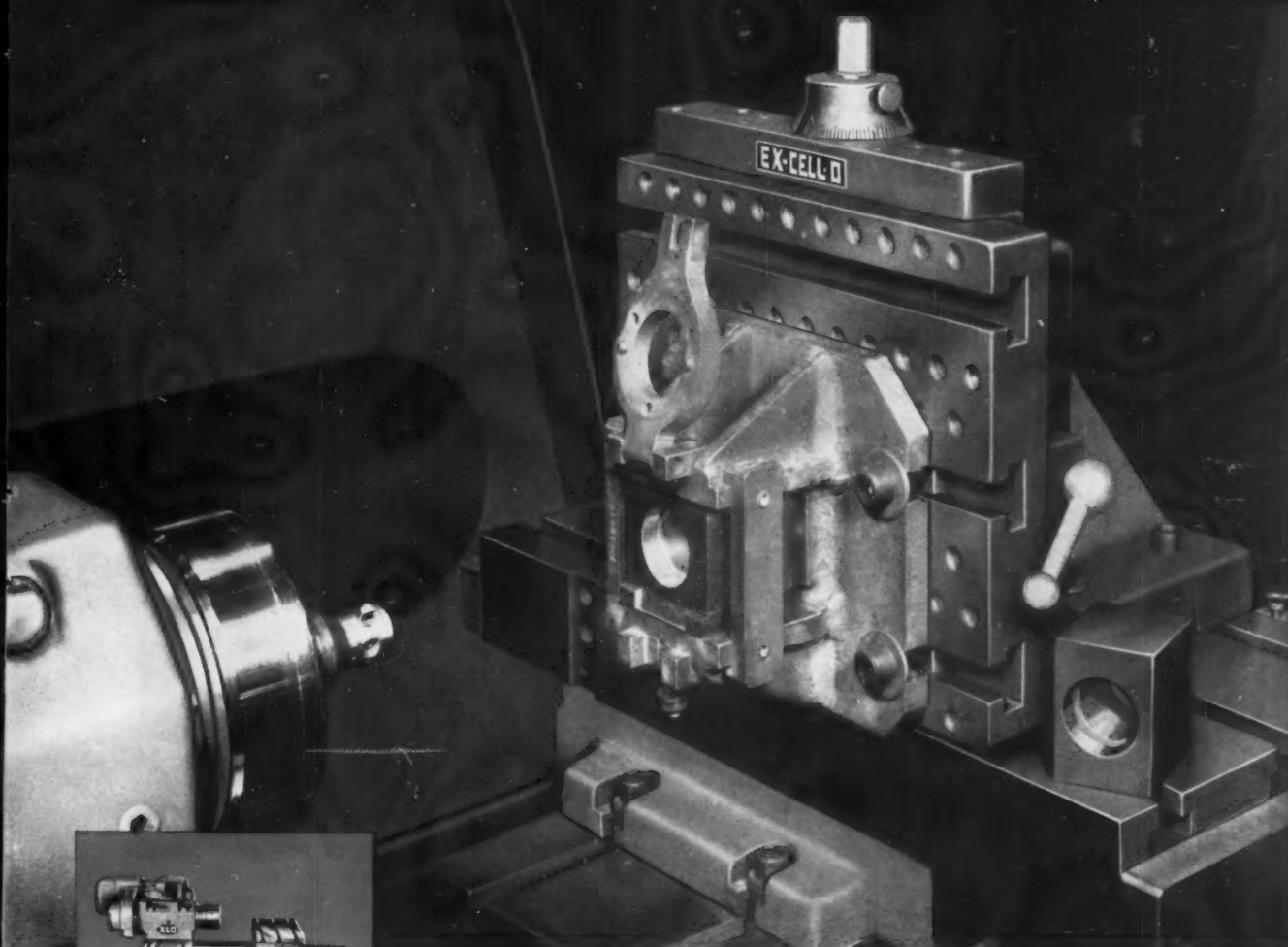
² Maximum diameter of cylindrical part shall not exceed maximum width across flats.

³ Height of the hexagon is measured from the bearing surface to top of arc.

Thread may be coarse- or fine-thread series, Class 2B; unless otherwise specified, fine-thread series shall be furnished.

Suitable material for steel nuts is covered by ASTM A-307; other materials will be as agreed upon by manufacturer and user.

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Close-up view of Ex-Cell-O Precision Boring Machine equipped with a single spindle and a universal fixture for small lot production.



2112-B single-end Ex-Cell-O Precision Boring Machine with horizontal cross slide fixture.



1212-B double-end Ex-Cell-O Precision Boring Machine with universal fixture having cross and vertical slides.

These versatile machines keep busy

Ideal machines for toolroom work and short production runs

These Ex-Cell-O Precision Boring Machines equipped for general-purpose work perform precision boring, turning, facing and chamfering operations quickly and economically.

They can be operated automatically or manually. Spindle speeds are easily changed to suit the operation. Universal fixture rigidly holds tools and

work pieces of many sizes and shapes. Horizontal and vertical slides of the fixture permit precision positioning of either tools or work.

A complete line of precision boring machines is available. For information just call your Ex-Cell-O representative or write Ex-Cell-O in Detroit.

EX-CELL-O
CORPORATION

EX-CELL-O
FOR
PRECISION

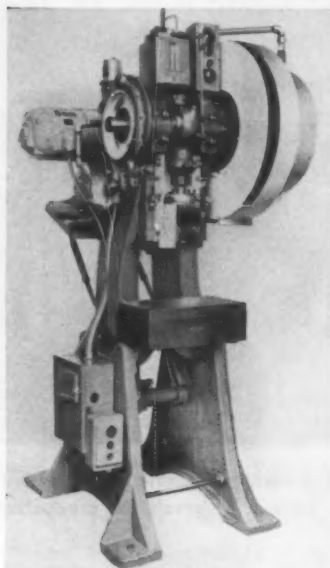
XLO

DETROIT 32, MICHIGAN MANUFACTURERS OF PRECISION MACHINE TOOLS • GRINDING SPINDLES • CUTTING TOOLS
RAILROAD PINS AND BUSHINGS • DRILL JIG BUSHINGS • AIRCRAFT AND MISCELLANEOUS PRODUCTION PARTS • DAIRY EQUIPMENT

Zeh & Hahnemann Reclinable Presses

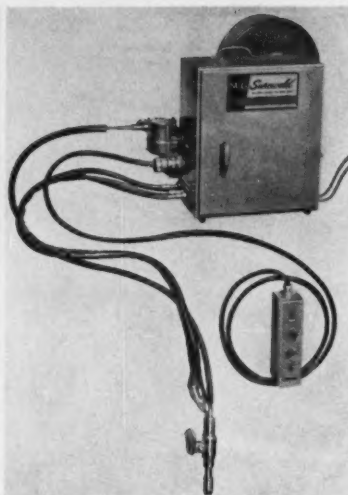
The first of a series of reclinable presses redesigned by Zeh & Hahnemann Co., Newark, N. J., to meet industry's demand for automation and increased production is now available. The presses in this new high-production line are built to obtain maximum rigidity and minimum deflection.

The design and arrangement of the flywheel in relation to the crankshaft serves to eliminate



High-production, reclinable press built by Zeh & Hahnemann Co.

harmful effects of bending stresses developed by the flywheel. Features include air clutch and brake; variable-speed drive; automatic lubrication; overload protection; adjustable stroke; electropneu-



Semi-automatic "Sureweld" inert-gas metal arc-welding outfit, left, and an automatic welding outfit, right

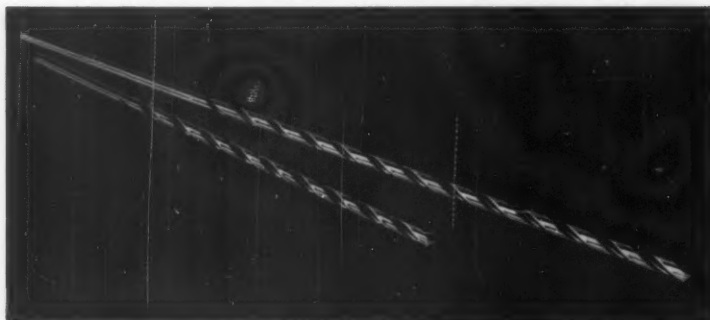
matic controls; and speeds ranging up to 600 strokes per minute. The high-production power press series includes reclinable, straight-side, and double-crank types.

Circle Item 150 on postcard, page 275

Stock Sizes for "Longboy" Drills

A variety of deep-hole drilling operations can now be performed with standard stock 18-inch "Longboy" drills recently developed by the Ace Drill Corporation, Adrian, Mich. The drills are available in many fractional sizes, ranging from 3/16- to 3/4-inch diameter. Also in stock are 12-inch "Longboys" and a complete line of standard drills, reamers, and hardened and ground high-speed steel drill blanks.

Circle Item 151 on postcard, page 275



Ace twist drills for deep-hole operations

"Sureweld" Automatic Welding Equipment

A line of "Sureweld" semi-automatic and fully automatic welding equipment that is said to provide maximum versatility and economy in inert-gas (including CO₂) metal arc-welding has been announced by the National Cylinder Gas Co., Chicago, Ill. The equipment, which consists of a welding control and electrode drive unit; a welding gun or automatic welding torch; and interconnecting gas and water cable assemblies, is designed for single-pass horizontal and flat position welding using a constant voltage type direct-current power source.

The function of this equipment in a consumable-electrode welding system is to feed the electrode into the arc at a constant, pre-selected speed. It provides a means for starting and stopping the arc, adjusting the rate of electrode feed, "inching" the electrode, controlling the power output, and controlling the flow of shielding gas. This is done automatically and in the proper sequence. There are four types of these welding outfits available, selection depending on the particular setup desired—semi-automatic, fully automatic, or with either work or torch stationary.

Circle Item 152 on postcard, page 275
(This section continued on page 262)

FOUND WHERE AIRCRAFT POWER AND CONTROLS TAKE SHAPE

GRAND RAPIDS GRINDERS

Bendix
BENDIX PRODUCTS
DIVISION
BENDIX AVIATION
CORP.



FAIRCHILD ENGINE
DIVISION
FAIRCHILD ENGINE
AND AIRPLANE CORP.



FORD INSTRUMENT
COMPANY
DIVISION OF
SPERRY RAND CORP.



HAMILTON
STANDARD DIVISION
UNITED AIRCRAFT
CORP.



LEAR, INCORPORATED



ORENDA ENGINES
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PRATT & WHITNEY
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AIRCRAFT CORP.



WRIGHT
AERONAUTICAL
DIVISION
CURTISS-WRIGHT
CORP.



**GALLMEYER
& LIVINGSTON**

Precision is paramount in the manufacture of components for aircraft power and control. That's why these makers of precision parts have Grand Rapids Grinders in their toolrooms—for the utmost in precision grinding.

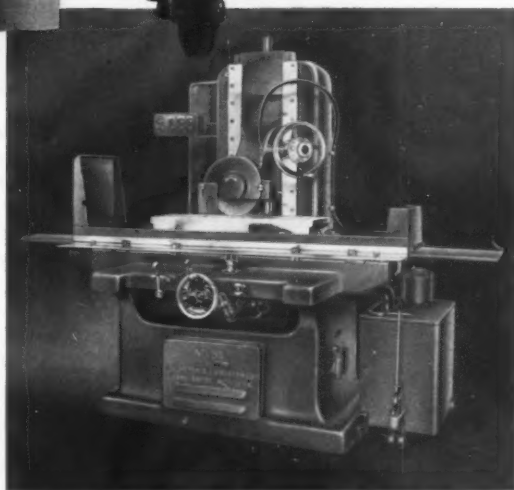
Model No. 55, for example, features one-piece column and base for permanent vibrationless rigidity. Longitudinal travel table and cross feed are hydraulically actuated. Wheel head has powered rapid vertical travel. And it's faster than any other grinder of this type and size . . . with variable table speed up to 125 fpm.

With these built-in precision features typical of all Grand Rapids Grinders, it's no wonder they're found in leading toolrooms.

A note on your letterhead will bring full details.



SUPER SABRE F-100
NORTH AMERICAN
AVIATION, INC.



GRAND RAPIDS No. 55 HYDRAULIC FEED SURFACE GRINDER. Table speed up to 125 fpm. Working surface of table is 12" x 36". Vertical movement of wheel head is 18". Preloaded ball bearing spindle greased for life. Spindle speeds 1925 and 2500 rpm.

GALLMEYER & LIVINGSTON COMPANY

305 Straight Ave., S.W., Grand Rapids, Michigan

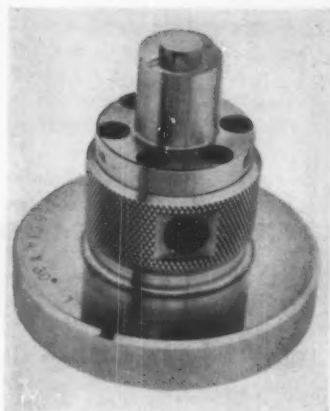


Fig. 1. Flush pin amplifier unit made by Holmes Gage & Development Corporation

Flush Pin Amplifier Unit

A flush pin amplifier unit that is adaptable to various types of gages and fixtures is being manufactured by the Holmes Gage

& Development Corporation, Columbus, Ohio. It is claimed that depths, chamfers, countersinks, and contours can be checked quickly and accurately with this device. The complete unit is hardened to Rockwell C-62 and gives a five-to-one amplification. It is designed for checking dimensions in the tolerance range from 0.010 to 0.001 inch. The amplifier unit is shown in Fig. 1.

Amplification is obtained as illustrated diagrammatically in Fig. 2 by the use of three precision balls A, a tapered pin B, and a tapered angle seat C. A step, five times the over-all tolerance, is ground into the top of the amplifier housing at D that provides for quick, accurate checking, without guesswork or conflicting readings. Maintenance costs are claimed to be negligible, as the rolling action of the balls is said to eliminate wear. Gage blanks

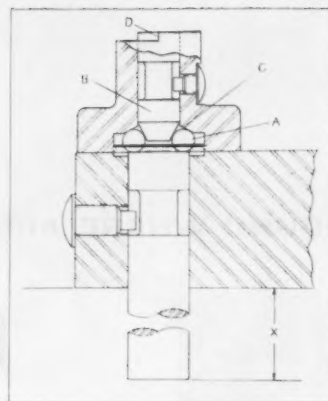


Fig. 2. Diagram illustrating construction and operation of gage shown in Fig. 1

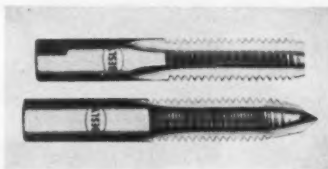
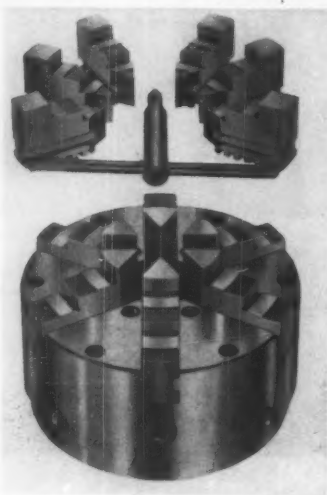
that are drilled and milled, to reduce weight without sacrificing rigidity, can be furnished for this unit by the manufacturer.

Circle Item 153 on postcard, page 275

Buck "Ajust-Tru" Chuck

Buck six-jaw "Ajust-Tru" chuck (also made in three-jaw model), in 8-, 10-, and 12-inch diameter sizes, has just been announced by the Buck Tool Co., Kalamazoo, Mich. These chucks provide all the features of the smaller sizes previously available. They can be accurately adjusted for heavy-duty precision chucking of duplicate pieces. Provision is made for automatic take-up for wear.

Circle Item 154 on postcard, page 275



Besly Stub Taps

Short shank stub taps for screw machines brought out by the Besly-Welles Corporation, South Beloit, Ill. These short-length taps eliminate the need for cutting and altering regular taps to fit or the ordering of "specials." Since these taps fit standard bushings, they also reduce and simplify the bushing inventory. They are available in regular sizes from No. 0 through No. 14 and from 1/4 through 1 inch.

Circle Item 155 on postcard, page 275

G-E Coolant-Pump Motor

Totally enclosed, fractional-horsepower motor, designed especially for driving machine tool coolant pumps, announced by the General Purpose Component Motor Department, General Electric Co., Schenectady, N. Y. This motor features the NEMA-C end-shield

for direct coupling to the pump and can be mounted horizontally or vertically. Smooth contours, including a closely fitted drip-cover, make the motor easy to keep free of accumulated metal and dirt particles. Large grease reservoirs are factory-filled with a new type grease that is highly resistant to moisture and oxidation. Locked ball bearings receive a constant supply of lubricant for ten years' normal operation. The terminal box, separated from the rotor fan and windings by a



Tube-In-Strip



REVERE'S

Revolutionary NEW Product—

IT'S SOLID!

Offers NEW ECONOMIES

Tube-In-Strip comes to you in long coils or in sheets, as you wish. You fabricate it by stamping, bending or otherwise forming it, and then by simple inflation you expand the longitudinal integral internal channels into tubes, round, half-round, rectangular, hexagonal, fluted, as your design calls for. There is your finished product!

Remember, Tube-In-Strip is solid, not a sandwich, not two pieces welded, brazed or bonded together. It is a single piece of flat metal containing inflatable channels that are located and sized to your specifications.

These metals are now available: Copper, Brass, other Copper Alloys, Aluminum. In development: Stainless and Low Carbon Steel.

The web between the tubes conducts heat faster. Structural strength is high, so you can use lighter gauges, saving in weight and price.

Since the initial announcement of this radically new Revere Product intense interest has been displayed by American industry. The Revere Sales Offices, the Technical Advisory Service and the Research and Development Department will be glad to provide additional information, and collaborate with you in taking advantage of this extraordinary new material.

HERE'S WHAT TUBE-IN-STRIP MEANS TO YOU:

MORE economical to buy

MORE economical to work

MORE strength

MORE efficiency

REVERE

COPPER AND BRASS INCORPORATED

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Mills: Baltimore, Md.; Brooklyn, N. Y.; Chicago, Clinton and Joliet, Ill.; Detroit, Mich.; Los Angeles and Riverside, Calif.; New Bedford, Mass.; Newport, Ark.; Rome, N. Y.
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BEVERAGE INDUSTRIES

ARCHITECTURE AND BUILDING

Structural
Decorative
Functional

MANY, MANY OTHER APPLICATIONS IN EVERY INDUSTRY

welded baffle, gives ample lead protection and space for necessary splice connections. A neoprene washer keeps moisture from entering around drip-cover locking screw and motor through-bolts. The motor is effectively cooled by conduction and radiation.

Circle Item 156 on postcard, page 275

Whitman & Barnes Drill Blanks

Complete line of drill blanks for use in all types of industrial applications, brought out by Whitman & Barnes, Plymouth, Mich. Intended primarily for the sizing of holes, these drill blanks can also be used for punches, knockout pins, gages, and rollers, as well as for stock for arbors, mandrels,

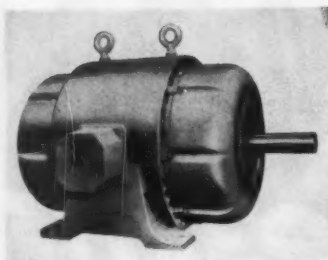


router bits, end-mills, etc. The drill blanks are the same length as jobbers' drills, hardened and ground to a tolerance of plus or minus 0.0003 inch. Precision blanks ground to a tolerance of plus 0.0002 to minus 0.0000 inch are also available at no extra cost. The drill blanks may be had in a complete range of fractional, letter, and wire gage sizes.

Circle Item 157 on postcard, page 275

Delco Totally Enclosed Fan-Cooled Motors

Totally enclosed, fan-cooled motor of new line covering size range from 50 to 200 H.P. announced by Delco Products Division, General Motors Corporation, Dayton, Ohio. The motor has two external cooling fans, one at each end, which draw cool air directly across each bearing, then drive it the length of the motor through

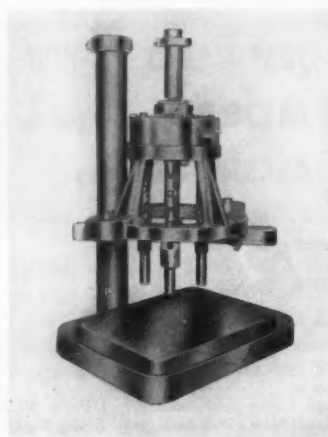


large cooling tunnels cast in the walls of the main frame. The fans are designed to direct the air onto the bearing housing with considerable force, removing heat and maintaining uniformly cool bearing temperatures. The large, non-clogging tunnels, being integral with the frame walls, provide efficient heat transfer to the air stream. In addition, each tunnel has a longitudinal fin to smooth out air flow and provide extra radiating surface.

Circle Item 158 on postcard, page 275

Errington Adjustable Drilling Head

No. 2 universal joint adjustable drilling head introduced by Errington Mechanical Laboratory, Inc., Staten Island, N. Y. All heads are made with No. 2 Morse taper sockets. The over-all length is 20 inches. Guide bars have bushings for 1- or 1 1/4-inch pins on 17 1/2-inch centers. The diameter of the lower clamping ring is 15 7/8 inches. Minimum center-to-center distance between holes is 1 5/8 inches, and the maximum diameter pattern, 9 3/4



inches. Approximate weight is from 60 to 75 pounds depending on the number of spindles. Case, cover, frame, and locator-arm castings are made of aluminum. All spindles are hardened and ground with gears turned on spindles. Heavy-duty grooved ball thrust bearings are provided on top and bottom of gear, and heavy-duty roller bearings are mounted on both ends of the gear shaft. All drill spindles have double needle bearings in locator arm and heavy-duty grooved ball thrust bearings. Spindles in head have Johnson bronze bearings.

Circle Item 159 on postcard, page 275



Electric "Impactool" with Automatic Torque Control

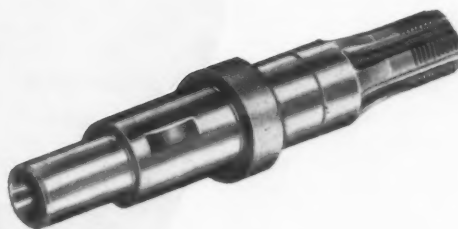
Electric "Impactool" designed to utilize the torsion-bar principle for automatic torque control in running down threaded nuts and bolts, announced by Ingersoll-Rand, New York City. This tool will run down fastenings with great power and speed to a preset torque, then automatically shut itself off. The tool is reversible, with full power being delivered in both directions. If specific torque is not desired, the selector knob which controls the automatic shut-off device in the tool is turned to the off position. The tool can be used by inexperienced operators. The 5UT "Impactool" has a 1/2-inch square drive, takes bolt sizes up to 5/8 inch in diameter, and weighs only 6 1/2 pounds. It has an over-all length of 10 1/4 inches less the torsion bar, with side to center dimension of 1 15/32 inches. The rated free speed, forward or reverse, is about 1900 R.P.M. Models are available for operation on 110- or 220-volt alternating or direct current.

Circle Item 160 on postcard, page 275



YOU'LL FIND G. S. GEARING IN TOP QUALITY PRODUCTS LIKE THESE . . .

Adding Machines • Aircraft Carburetors & Fuel Metering Systems • Aircraft Instruments and Radios • Automatic Musical Instruments • Business Machines • Chain Saws • Check Signing & Protecting Machines • Clippers for Barbers, Animal Shearing & Hedge Trimming • Cloth Cutting Machines • Coin Changers & Counters • Communication Equipment • Electric Fans • Electric Motors • Floor Polishers, Sanders, Scrubbers, Sweepers • Food & Drink Mixers, Blenders • Home Appliances • Lawn Sprinklers • Machine Tools • Meat Tenderizers, Grinders, Slicers • Military Equipment • Motion Picture Cameras & Projectors • Outboard Motors • Pneumatic Production Tools • Portable Electric Tools • Radio & Radar Tuning Assemblies • Radio Anti-backlash Gears • Record Changers • Sewing Machines • Steel Strap Stretchers • Stop Switches • Tapping, Drilling & Threading Equipment • Telephone Dials • Television Sets • Thermostatic Controls • Typewriters • Vending Machines • Washing Machines.



RUGGED MERCURY CHAIN SAW ASSURES UNFAILING SERVICE WITH G. S. GEARING

Rugged dependability is traditional of all MERCURY engines manufactured by the KIEKHAEFER CORPORATION. Their new Chain Saw, with Gearing by G.S., is designed and built to stand up under the hardest kind of service. ★ More and more manufacturers of TOP QUALITY mechanisms are turning to G.S. for Small Gearing. For, here at "Headquarters", they get extreme uniform accuracy! Assembly lines keep rolling. Rejects vanish. Costs come down. Customer satisfaction increases as products run smoother, quieter, longer. Start now enjoying all the superior advantages only G.S. Gearing can give. Send along drawings or descriptions today.

SEND FOR FREE 6-page *Small Gearing Guide*. It describes 80 types and applications. Contains useful charts . . . a valuable aid to anyone interested in Small Gearing. Use company letterhead, please. No obligation, of course. Write today!

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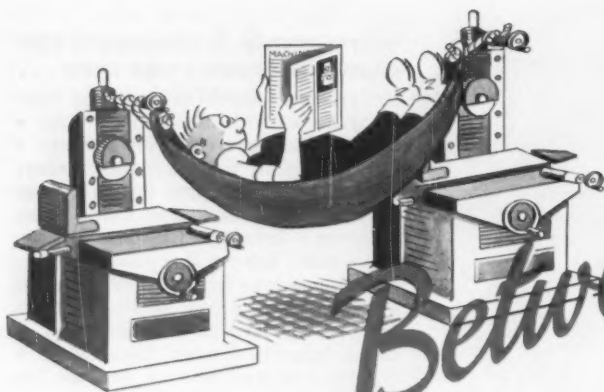
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40 Years of Specializing in Small Gearing!



Between Grinds

By E. S. Salichs

The Motorist's Mistake

Your B.C. columnist is back from vacation, a more cautious driver than before. While on the open highway we stepped on the gas to simultaneously overtake two automobiles moving at a merry clip. But it seems that the first car, driven by the sheriff of a town we had just passed through, was chasing the second car. Our gesture was more than the sheriff could stand, for he dropped the chase and nabbed us instead. Hauled back to the town, we paid our fine to a justice of the peace and started out again, well within the lawful speed. Ten minutes later, the same sheriff pulled up and stopped us, this time smilingly handing us our eyeglasses, which we had left in the J.P.'s office.

Puff This

"Sludgie," the dog that advertises in promotional literature and on billboards oil filters made by the AC Spark Plug Division of General Mo-

tors, now has twin pups, born of the artist's brush. To announce the event, the public relations department sent out cigars in aluminum tubes, one of which was received by our Editor. So he good-naturedly tried it out while dictating. "How did you know, Miss Smith, that a dog gave it to me?"

Pits and Grits

To remove enamel from hair-thin wires used in electrical coils for thermostats, Minneapolis-Honeywell engineers decided to bombard the coils with finely ground pecan shells and apricot pits. The elements are now being manufactured at the rate of 1000 an hour instead of the previous 1000 a day. The production manager's summary was presumably "It's the nuts."

Catch That Sidewalk

R. C. Sollenberger, executive vice-president of the Conveyor Equipment Manufacturers Association, foresees

"moving sidewalks" carrying suburbanites from fringe parking lots to the downtown areas of large cities, thereby keeping automobiles out of congested streets.

Taking the Rat From the Rat-Tat-Tat

Armour Research Foundation has designed a vibrationless pneumatic hammer, using the same concept employed in the development of recoil systems for fast-firing weapons. Hammer operators will be thankful for less quivering muscles and jangled nerves.

Coast-to-Coast Host

To celebrate dedication of the GM Technical Center, General Motors Corporation held an international open house in the United States and Canada at 114 plants, 15 training centers, and the GM Institute, with almost 1,000,000 visitors in attendance.



STURDY STARRETTITE—On his eightieth birthday, and sixty-fourth year of employment at the L. S. Starrett Co., Athol, Mass., Patrick Glennon didn't even take time out to remove his apron as he received a company stock certificate from Arthur H. Starrett, president of the company, in the presence of other executives and co-workers. Pat started as an errand boy in 1892. He showed keen interest in precision work, and eventually became a milling machine operator, in which capacity he is still going strong.

Do the **BIG** jobs . . .
and the small ones too
on a **BRYANT**

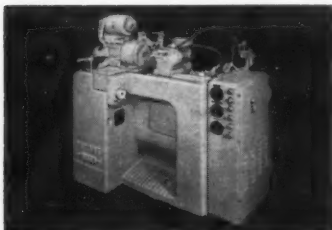
MODEL 1460 Hydraulically operated. Chuck swing of 60", total wheelside stroke of 21"; maximum grinding stroke of 16".



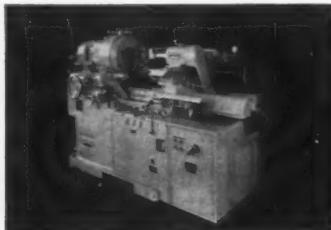
No matter what your internal grinding problem may be, it can be solved effectively with a Bryant Internal Grinder.

Bryant's great variety of manual, semi-automatic and automatic grinders is your assurance of a machine that is tailored to meet your production requirements.

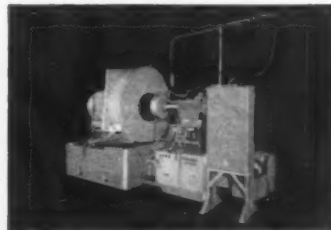
Investigate how Bryant's engineering services can help you attain higher production at lower operating costs.



MODEL 1109 A precision internal grinder, suitable for covering the range of smaller bore sizes. Total swing of 9"; maximum grinding stroke of 3½".



MODEL 1116 Tops for both toolroom and general production work. Total chuck swing 16"; maximum grinding stroke 8".



MODEL 1480 Total chuck swing of 80". Spindle has a 9" bore so work can be extended back if necessary.

BRYANT Chucking Grinder Co.

20 CLINTON STREET, SPRINGFIELD, VERMONT

Offices: Indianapolis • Cleveland • Chicago • Detroit • Mt. Vernon, N. Y. • Philadelphia

Internal Grinders • Internal & External Thread Gages • Granite Surface Plates • Magnetic Drums for Computers • Special Machinery

For more information fill in page number on Inquiry Card, on page 275

MACHINERY, November, 1956—267

News OF THE INDUSTRY

Illinois and Indiana

JOSEPH T. RYERSON & SON, INC., Chicago, Ill., has made GEORGE B. HOWELL manager of sales of tubular products and cold-finished steel bars at its Detroit, Mich., plant. He joined Ryerson in 1948. The same post at the company's Philadelphia, Pa., plant is now filled by WILLIAM J. CLEARY.

CHARLES C. BARNETT, JR., has been appointed regional sales manager of Western Brass Mills Division, Olin Mathieson Chemical Corporation, East Alton, Ill. Mr. Barnett's territory includes the southern and western states and also the Cincinnati and Indianapolis areas. His headquarters will be the East Alton office.

VERSON ALLSTEEL PRESS CO., Chicago, Ill., has opened a 6000-square-foot addition to its existing offices at 93rd St. and Kenwood. DONALD WEISS has been named district sales manager for Ohio and Kentucky. His headquarters are in Hamilton, Ohio.

PHILLIP DELMER has been made manager of hydraulic press sales for the Clearing Machine Corporation, Division of U. S. Industries, Inc., Chicago, Ill. CARL NOWAK, his pred-

ecessor, will continue to act as a consultant.

HANNIFIN CORPORATION, Des Plaines, Ill., has named H. J. ANDRESEN sales manager for its new Crown line of filters, regulators, and lubricators.

LINK-BELT CO., Chicago, Ill., has moved its Cleveland, Ohio, office to larger quarters in a new building at 3592 Lee Rd.

CHARLES G. CHISHOLM has been appointed general sales manager of Haynes Stellite Co., a division of Union Carbide and Carbon Corporation, Kokomo, Ind.

Michigan

VICKERS INCORPORATED, Detroit, Mich., has named LOUIS G. JORDAN assistant chief engineer for industrial products and CARL A. BROWN assistant chief engineer for automation systems. During his twenty-one years with the company, Mr. Jordan has specialized in hydraulic piston pump, motor, and transmission design and development. Mr. Brown, who has been with Vickers for more than twenty years, has had a broad range of assignments involving design and development of special hy-

draulic machinery and devices. Also announced was the recent appointment of A. TRAIL as manager of the company's Rochester, N. Y., district sales office.

MICHIGAN TOOL CO., Detroit, Mich., announces the appointment of HAROLD S. ATHERTON as advertising manager and RICHARD S. HILDRETH as assistant chief engineer. Mr. Atherton was formerly associated with Denham & Co. as an account executive. Mr. Hildreth was assistant chief tool designer prior to his present appointment.

GEAR GRINDING MACHINE CO., Detroit, Mich., appointed WILLIAM F. WILSON executive vice-president. WILLIAM J. TAYLOR was named vice-president and general manager of its subsidiary, Republic Gear Co., and FRED F. MILLER has been made vice-president of its subsidiary, Detroit Bevel Gear Co. Mr. Wilson was formerly vice-president in charge of engineering and manufacturing at the parent company. Mr. Taylor moves into Republic from Detroit Bevel where he served eleven years. Mr. Miller, a twenty-two-year veteran with Gear Grinding and Detroit Bevel, was vice-president of operations and director of engineering at Detroit Bevel.



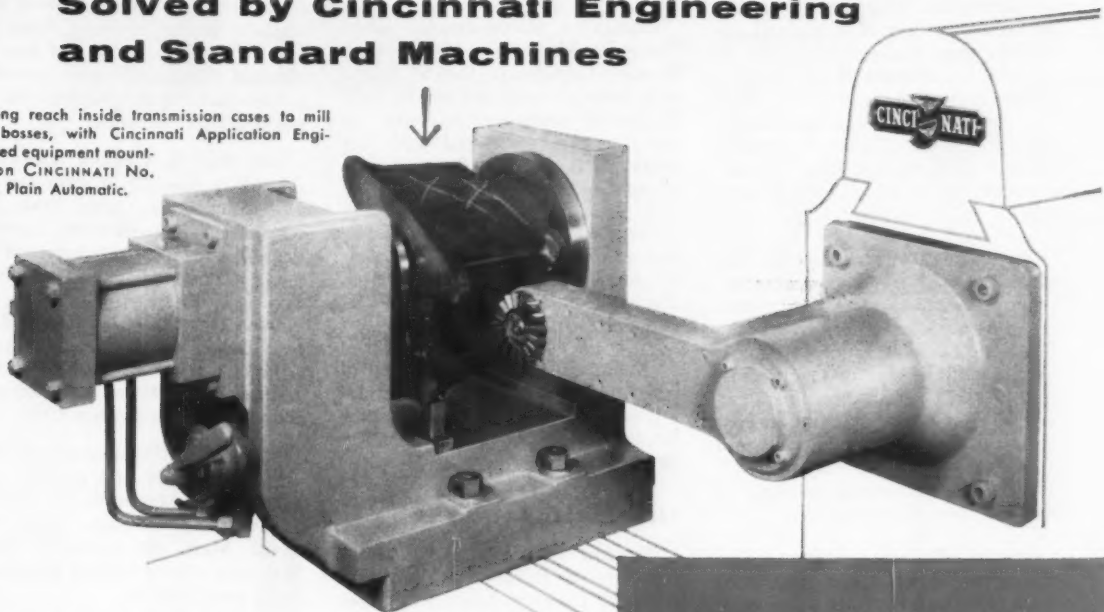
W. F. Wilson (left), executive vice-president of Gear Grinding Machine Co.; W. J. Taylor (center), vice-president and general manager of Republic Gear Co.; and F. F. Miller (right), vice-president of Detroit Bevel Gear Co.

(This section continued on page 270)

It's An Inside Job

**Solved by Cincinnati Engineering
and Standard Machines**

A long reach inside transmission cases to mill the bosses, with Cincinnati Application Engineered equipment mounted on CINCINNATI No. 1-18 Plain Automatic.



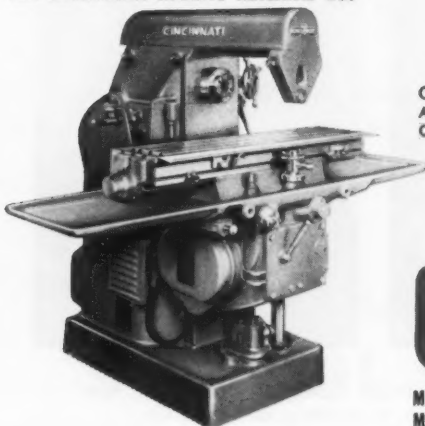
How would you reach deep inside a casting to machine bolt bosses? Cincinnati Application Engineers, long experienced in solving tricky machining operations, tooled up the inside job shown here with a long reach right-angle milling attachment mounted on a standard CINCINNATI® No. 1-18 Plain Automatic Miller. To reduce tiring physical effort, the work is held in an air operated fixture.

The 1-18's fast automatic table cycle, with a feed rate of 11 in. per min., keeps production going at a rate of about 100 transmission cases per hour.

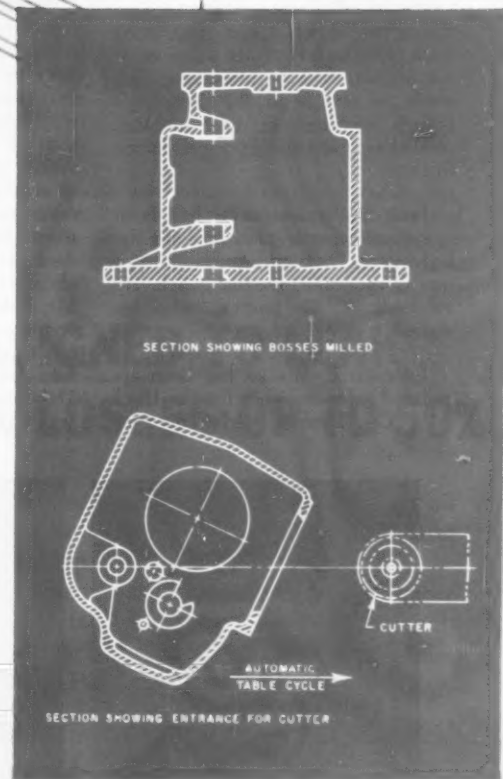
Although this is a rather simple setup, it illustrates what Cincinnati Engineering Service and standard Cincinnati Milling Machines can do for you. ¶ Here's a good point to consider for your next milling machine requisition: standard Cincinnati's range from ½ hp drive to 50 hp drive, and hundreds of sizes in between. You might like to learn more about the production pacemaker shown here, the No. 1-18 Plain Automatic. Ask for catalog No. M-1555-3, or look in Sweet's for brief specifications.

THE CINCINNATI MILLING MACHINE CO.

CINCINNATI 9, OHIO



CINCINNATI No. 1-18 Plain Automatic Milling Machine, Catalog No. M-1555-3.



CINCINNATI



MILLING MACHINES • CUTTER SHARPENING MACHINES • BROACHING MACHINES • METAL FORMING MACHINES • FLAME HARDENING MACHINES • OPTICAL PROJECTION PROFILE GRINDERS • CUTTING FLUID

SQUARE D Co., Detroit, Mich., has named WALTER NOLLENBERGER manager of a new plant to be built in Lexington, Ky., and STEPHEN KOVACH, manager of a regional assembly plant under construction in Atlanta, Ga. WILBUR H. PETER, JR., has been elected a vice-president of the company and has been made manager of the Electric Controller Division in Cleveland, Ohio. He succeeds ALVIN C. DYER, who is retiring.

PROGRESSIVE WELDER SALES Co., Detroit, Mich., announces these appointments: L. F. VAN NORTWICK, as general sales manager of the Frostrade Division; BERNIE WALKER, as assistant director of manufacturing; EARL R. STIEFEL, as director of purchases; GEORGE W. ENK, as general sales manager for domestic and Canadian operations; and E. J. FORMHALS, as general manager of the Chatham, Ontario, plant.

DETROIT BROACH & MACHINE Co., Rochester, Mich., has appointed CAM MORAWSKI to its sales engineering staff. Mr. Morawski, formerly in charge of the company's broach engineering, will be succeeded in that capacity by STANLEY STATON.

JACK E. STEINHELPER has been named director of personnel for the Kelvinator Division, American Motors Corporation, Detroit, Mich. He succeeds L. G. SPICER, who resigned.

EDWARD F. WALSH has been appointed sales engineer for the Huck Mfg. Co., Detroit, Mich. His territory

includes lower New York, Long Island, and western New Jersey.

NORMAN A. MATTHEWS has joined General Electric's Metallurgical Products Department, Detroit, Mich., as a research engineer in the field of special inorganic materials. He was formerly associated with the American Brake Shoe Co. as a metallurgist.

SMITCO, INC., Cleveland, Ohio, makers of shaving and skiving tools for screw machines, has appointed EMPIRE TOOL Co., Detroit, Mich., national distributors.

WELDEX, INC., manufacturer of resistance welders and special welding machinery, has moved to a new location at 18425 Weaver St., Detroit, Mich.

New England

NORTON Co., Worcester, Mass., has created three new divisions—Abrasive Division, headed by JOHN JEPSON as vice-president and general manager; Refractories Division, with WILLIAM G. FALLON as general manager; and Electro-Chemical Division, headed by HOWARD J. DALY as vice-president and general manager. Prior to his present appointment, Mr. Jeppson was vice-president in charge of manufacture of abrasive and refractory products. Mr. Fallon, with the company thirteen years, was assistant manager of refractories and electro products before his present appointment. Mr. Daly joined Norton Co. in 1922. He was elected to the board of direc-

tors in 1953 and made vice-president in charge of crude abrasive plants in January of this year. JOHN E. TAYLOR has been appointed field engineer at the Cleveland, Ohio, district office. Also announced was the planned construction of a two-story service building at Worcester for the engineering department.

WILLIAM J. GREENE, vice-president and director of sales for the L. S. Starrett Co., Athol, Mass., has retired. CARL O. NEWTON, formerly general sales manager, succeeds Mr. Greene. The new general sales manager is CORTLAND A. BASSETT. Mr. Greene was with the company for forty-two years. Mr. Newton, elected a director in 1955, joined Starrett in 1929, and Mr. Bassett has been associated with Starrett since 1946.

F. KENNETH MORRISON has been named president and general manager of the Mason-Neilan Division of Worthington Corporation, Norwood, Mass. He succeeds ELDON MACLEOD, who is retiring after forty-three years' service.

BESLY - WELLES CORPORATION, South Beloit, Ill., has appointed LIBB TOOL Co., INC., 75 Laurel St., Hartford, Conn., distributor for its complete line of cutting tools and gages.

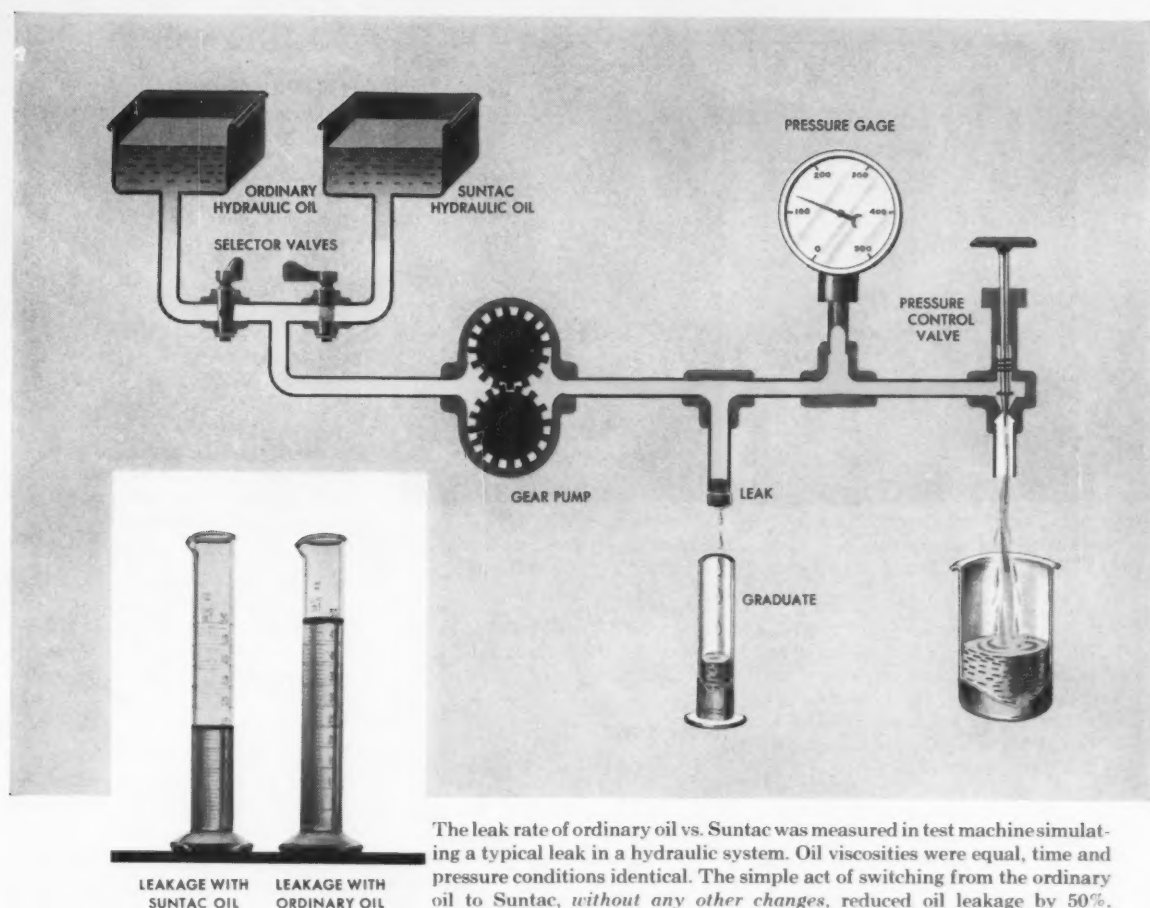
BARDEN CORPORATION, Danbury, Conn., manufacturer of precision ball bearings, has appointed HAROLD H. GILLESPIE, EMIL J. KARKUT, and RAYMOND S. MANN vice-presidents.

PRECISION STEEL CORPORATION, Bridgeport, Conn., has appointed ROBERT M. CLARKE manager of sales.



John Jeppson (left), W. G. Fallon (center), and H. J. Daly (right), heads of the Abrasive Division, Refractories Division, and Electro-Chemical Division, respectively, of Norton Co.

(This section continued on page 272)



PRESSURE SYSTEM DESIGNED TO LEAK PROVES SUNTAC CUTS OIL LOSSES UP TO 50%

If you're having troubles with excessive oil leakage, a Suntac® oil can help you. Because of their unusual anti-leak characteristics, Suntac oils reduce oil consumption up to 90%, users report.

Suntac oils will not gum up or otherwise harm circulating systems. These oils are high-quality petroleum products with a life expectancy longer than that of ordinary hydraulic and circulating oils.

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Your Sun representative can tell you more about Suntac oils. Or write for Technical Bulletin 23. Address SUN OIL COMPANY, Philadelphia 3, Pa., Dept. M-11.



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For more information fill in page number on Inquiry Card, on page 275

MACHINERY, November, 1956—271



A. H. d'Arcambal (left), retiring president and general manager of Pratt & Whitney, and his successor, E. P. Gillane

PRATT & WHITNEY CO., INC., West Hartford, Conn., has appointed EDWARD P. GILLANE president and general manager. He succeeds ALEXANDER H. d'ARCAMBAL, who is retiring. Mr. Gillane, associated with the Potter & Johnston Division since 1948, was elected executive vice-president of Pratt & Whitney last June. Mr. d'Arcambal will remain active in company affairs in a consulting capacity and as honorary chairman of its board of directors. WILLIAM C. MULLIN has been named sales manager for instrument gages of the Gage Division. He joined the company in 1947 and has been chief gage sales engineer since January 1955.

C. N. FLAGG & CO., INC., Meriden, Conn., announces the election of two vice-presidents—PAUL A. CELLA, vice-president of the plant division; and C. L. O'NEAL, vice-president of the pipeline department.

BROWN & SHARPE MFG. CO., Providence, R. I., in a reorganization of its management structure, has appointed WALLACE B. BAINTON vice-president and general manager for machine tools, and WALLACE E. ANDERSON vice-president and general manager for industrial products. JOSEPH E. KOCHAN has been made director of systems and audits. Two largely independent end-product divisions have been set up—the Machine Tool Division and the Industrial Products Division, each with separate engineering, production, and field sales organizations. Other appointments include ERMAND L. WATELET as superintendent of the precision tool and gage group, and

DUNCAN H. DOOLITTLE as superintendent of the miller and grinding machine group.

New York

LIBERTY PRODUCTS CORPORATION, subsidiary of Penn-Texas Corporation, Farmingdale, L. I., has elected ERICH SCHATZKI president and member of the board. He succeeds ROBERT SIMON, who will continue as a consultant and board member. ROBERT F. FRESH, former assistant controller of Olin Mathieson Chemical Corporation, has been elected treasurer and controller.

ETTCO TOOL & MACHINE CO., INC., is the new name for the forty-five-year-old Brooklyn, N. Y., manufacturer of Ettco-Emrick drilling and tapping equipment. The new name better reflects the full scope of the company's activity.

NIAGARA MACHINE & TOOL WORKS, Buffalo, N. Y., has established a district office in Indianapolis, Ind. It will be managed by FRANK L. KELSEY.

ELMER D. ROBINSON, former assistant to the president, Morse Chain Co., Ithaca, N. Y., has been appointed director of manufacturing.

CARPENTER STEEL CO., Reading, Pa., has opened a new warehouse in Buffalo, N. Y.

DICK M. LANDIS has been appointed assistant general manager of De Laval Pacific Co., Poughkeepsie, N. Y.

FREDERICK A. FIELDER has been named general sales manager of Loewy-Hydropress Division of the Baldwin - Lima - Hamilton Corporation, New York City.

GENERAL ELECTRIC CO., Schenectady, N. Y., is investing \$1,500,000 in a developmental laboratory for its Medium Induction Motor Department.

Ohio

STERLING FOUNDRY CO., Wellington, Ohio, a Warner & Swasey subsidiary, has acquired in excess of 90 per cent of the outstanding shares of Brown Industries, Inc., a foundry in Sandusky, Ohio. Brown Industries will operate as an independent unit under Sterling Foundry management.

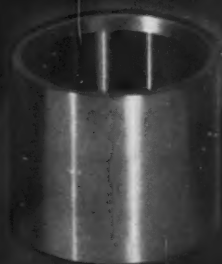
RALPH C. REINHART has been named director of manufacturing by the Baker-Raulang Co., Cleveland, Ohio, manufacturer of gas and electric materials-handling trucks. ROBERT J. LAWS is the new assistant chief engineer.

GENE R. VOIGT has been promoted to sales manager of the Air Tool Division of Aro Equipment Corporation, Bryan, Ohio.

ALBERT S. BURGOWNE has been appointed vice-president in charge of manufacturing of the E. W. Bliss Co., Canton, Ohio. Mr. Burgoyne will be responsible for coordinating and directing the activities of the company's twelve manufacturing plants. Formerly he was with the gage division of Pratt & Whitney.



Albert S. Burgoyne, vice-president—manufacturing, E. W. Bliss Co. (This section continued on page 280)



EX-CELL-O BUSHINGS LAST TWICE AS LONG

Customer's test proves there IS a difference in bushings

Recently one of the world's largest manufacturers of heavy equipment proved beyond doubt Ex-Cell-O Bushings last twice as long as the other bushings tested. That's good news for all users of bushings! After drilling 16,300 holes, leading bushing brands were measured. Wear on other makes of bushings averaged .0039"—ready for scrap—but wear in Ex-Cell-O Bushings averaged only .0017".

The reasons for this outstanding showing: (1) Ex-Cell-O Bushings are made of high chrome, high carbon oil-hardening bearing steel, (2) automatic atmosphere-

controlled heat treating for uniform hardness, (3) precision grinding inside and out, (4) head type bushings and liners are ground under the head for perfect seating.

These bushings take the toughest production runs in stride. Make your own test—see and compare Ex-Cell-O.

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The Chicago Pneumatic Air Hoist's powerful variable speed rotary vane motor can be accelerated from a snail's pace to full speed . . . raises loads rapidly, sets them down gently. The Air Hoist is ideal for accurately spotting loads into position. Its fingertip pendant throttle places lifting and lowering controls in one hand . . . leaves other hand free for guiding the load along a tramrail and then lowering it into position.

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On New Catalogues described in this issue of **MACHINERY**
On New Shop Equipment described in the editorial pages
On products shown in the advertisements

NEW CATALOGUES

PRECISION CASTING—Shaw Process Development Corporation, a subsidiary of British Industries Corporation. Booklet containing a complete review of the development, operation, and applications of the Shaw process of precision investment casting. The Shaw process opens a new field by producing a precision investment casting similar in accuracy and finish to "lost wax casting" but up to 1/2 ton and larger in size from simple refractory molds, utilizing low-cost patterns and equipment. This process is already utilized by a number of foundries for the manufacture of aircraft engine parts, air-frame parts, guided missile parts, and many other similar parts. For a complimentary copy of this booklet, write on company letterhead to Department PR-10, Shaw Process Development Corporation, 80 Shore Road, Port Washington, N. Y.

SELF-LOCKING SOCKET SCREWS—Standard Pressed Steel Co., Jenkintown, Pa. 16-page booklet describing and illustrating the company's Nylok locking principle and giving examples suggesting a variety of applications in which vibration-proof screws can be used to eliminate the use of lock washers, wired heads, or other extras. Sizes, critical dimensions, threads per inch, package quantities, and weight per box are given for Unbrako socket head cap-screws, socket head set-screws, button head socket screws, flat head socket screws, socket head shoulder screws, and socket pressure plugs.1

SERVO SYSTEMS—Servo Corporation of America, New Hyde Park, N. Y. 48-page pocket book entitled "Murder in the Model Shop," presenting in original detective-story style the solution of servo system and instrument design problems by the use of Servoboard electromechanical assembly kits. This detective "thriller" (based on actual design engineering problems) is followed by a section that details the applications, advantages, and precision components of the company's Servoboard kits.2

ALUMINUM FORGINGS—Aluminum Company of America, Pittsburgh, Pa. Booklet entitled "Technical Data on Alcoa Hand Forgings," describing the high-strength, low-weight advantages of aluminum for parts of limited production. Minimum mechanical properties of the three standard hand-forging alloys are listed in easy-to-read tables. Finish

allowance, dimensional tolerance, and straightness tolerance for the company's hand forgings are presented in graph form.3

ABRASIVES—Norton Co., Worcester, Mass. 76-page booklet Form 501, entitled "Barrel-Finishing with Norton Tumblex Abrasives," giving information on types of barrels, selection of abrasive, cleaners, time cycles, and other facts about barrel finishing. Included are before-and-after photographs and case histories of actual examples of deburring, finishing for plating, and precision forming of radii to blueprint specifications.4

STEELS FOR GLASS-TO-METAL SEALS—Allegheny Ludlum Steel Corporation, Pittsburgh, Pa. 4-page technical sheet giving information on surface and expansion requirements, as well as other data on the five steels which are utilized for applications and designs of glass-to-metal seals. These applications include automobile sealed-beam headlights, fluorescent lights, electronic tubes, and various other specialized seals.5

FLAW LOCATION—Turco Products, Inc., Los Angeles, Calif. 4-page folder entitled "How to Perform Dye Penetrant Inspections." This folder thoroughly discusses every aspect of penetrant flow location, precleaning, applying penetrant, removing excess penetrant, applying developer, and interpreting results. Special emphasis is placed on the precleaning step, and

methods of removing all types of soil are thoroughly outlined.6

SPEED REDUCERS—Westinghouse Electric Corporation, Pittsburgh, Pa. Booklet B-6727, entitled "Speed Reducer Engineering Manual," presenting complete application information such as horsepower ratings, torque capacity, overhung load values, dimensions, construction features, installations, and maintenance for single, double, and triple reduction. Speed reducers may be driven by electric motors, gas, oil, or Diesel engines.7

AIR CLEANERS—Wheelabrator Corporation, Mishawaka, Ind. Bulletin 557-D, describing the company's industrial cloth-filter type dust collectors. Dealing with the ultra-filtration process, the bulletin presents two case histories of installations where this process was used for cleaning dust out of ordinary city air.8

TURRET DRILLING MACHINE—Howe & Fant, Inc., East Norwalk, Conn. 20-page brochure 55-11 entitled "New Dollars for You," describing the time-saving qualities of the company's turret drilling machine. The initial cost, power and maintenance cost, floor space savings, setup, handling, and down time, plus a breakdown on annual savings are covered.9

METAL SHEET FEEDER—Dexter Folder Co., New York City. 6-page catalogue describing the company's 125-sheet-per-minute metal sheet feeder which handles

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PLASTIC PIPE—American Hard Rubber Co., New York City. 8-page Bulletin CE-57, containing information on: applications for Supplex pipe, sizes of standard pipe and fittings, installation instruc-

tions, technical properties, and estimated flow rates for water in various pipe sizes.27

COLD HEADING MACHINE—Waterbury Farrel Foundry & Machine Co., Waterbury, Conn. Bulletin illustrating and describing the company's solid-die, double-stroke cold header. Covered are various design features of this machine which enable it to head rivet and screw blanks at rates of 300 to 450 per minute.28

SAFETY DATA—Norton Co., Worcester, Mass. Booklet entitled "Safety," discussing briefly the causes of accidents and how the company's safety program operates to eliminate hazards. The booklet covers such subjects as available protective equipment, machine guards, signs, safety rules, and various others.29

RADIAL DRILLS—Western Machine Tool Works, Holland, Mich. Catalogue 5634, covering the company's line of radial drills for medium duty. These are available in arm lengths from 3 to 6 feet and 6, 9, or 18 spindle speeds up to 2000 R.P.M. with optional ranges.30

CHAIN SLING FITTINGS—Bolt and Chain Division, Republic Steel Corporation, Cleveland, Ohio. 42-page catalogue explaining the terminology of chain slings to assist buyers and users in specifying exactly what they require in maximum safety, service, and economy.31

TEMPERATURE INDICATORS—Leeds & Northrup Co., Philadelphia, Pa. Data Sheet ND42-33(1), giving complete information on the company's portable direct-reading thermo-couple potentiometer indicators with automatic reference junction compensation.32

GRINDING MACHINES—Cincinnati Milling Machine Co., Cincinnati, Ohio. Illustrated catalogue No. G-637-2, describing the company's automatic balancing feature for Cincinnati Filmatic plain, roll, and centerless grinding machines.33

AUTOMATIC ASSEMBLY TOOLING—Ferguson Machine Corporation, Hicks Development Division, Lebanon, Ind. Bulletin 500, describing applications of standard "Intermittor" rotary, and "Trans-O-Mator" in-line, automatic assembly machine bases.34

CONTROLLABLE CHECK VALVES—Tactair Valve Division, Aircraft Products Co., Bridgeport, Pa. Leaflet describing the company's Series 5900 line of rotary type controllable check valves for 3000-pounds-per-square-inch service.35

SUB-ZERO TEMPERATURE CABINETS—Webber Engineering Corporation, Indianapolis, Ind. Bulletin 61, describing the company's Model WE-2-140 sub-zero temperature cabinets of 2-cubic-foot capacity featuring front or top opening.36

RADIOGRAPHY DATA—North American Philips Co., Inc., Mount Vernon, N. Y. 12-page booklet entitled "Norelco X-Ray for Industry," containing operating and application data on six different types of radiography units.37

DIRECT-CURRENT MOTORS—Allis-Chalmers Mfg. Co., Milwaukee, Wis. Catalogue 5388424, describing the company's direct-current motors from 1/2 through 200 H.P. and motor-generator sets up to 200 K.W. output.38

SELF-LOCKING NUTS—Con-Torq Inc., a subsidiary of North & Judd Mfg. Co., New Britain, Conn. Catalogue describing the company's self-locking metal nuts made for several bolt and screw sizes—ranging from No. 4 through 5/16 inch.39

AIR CYLINDERS—S-P Mfg. Corporation, Solon, Ohio. Catalogue 110, covering the company's Series A non-rotating air cylinders and giving engineering data on its line of air cylinders, valves, and accessories.40

ULTRASONIC CLEANING EQUIPMENT—Branson Ultrasonic Corporation, Stamford, Conn. Leaflet describing the company's Model AP-10-B ultrasonic cleaning apparatus, the latest in the Sonogen series of similar units.41

AUTOMATIC BOILERS—Orr & Sem-bower, Inc., Reading, Pa. 4-page bulletin No. 1233, describing the company's Power-Pak packaged automatic boilers for steam or hot water heating and hot water service.42

PIPE, TUBES, AND WELDING FITTINGS—Babcock & Wilcox Co., Tubular Products Division, Beaver Falls, Pa. Catalogue TDC-146A, giving technical information on pipe, tubes, and welding fittings.43

X-WELD CHAIN—American Chain Division, American Chain & Cable Co., York, Pa. 4-page bulletin DH-319, describing the company's Accoloy X-Weld 125 Chain which is said to resist bending, breaking, and kinking.44

OIL CUPS—Oil-Rite Corporation, Manitowoc, Wis. Catalogue 10, describing the company's constant-level oiler which has recently been developed and released.45

OXYGEN CYLINDER—Linde Air Products Company, a Division of Union Carbide and Carbon Corporation, New York

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DISTRIBUTION SYSTEMS FOR LUBRICATORS—Bijur Lubricating Corporation, Rochelle Park, N. J. Bulletin 4A, describ-

SOCKET SCREWS—Cleveland Cap Screw Co., Cleveland, Ohio. 4-page illustrated

GENERAL - PURPOSE PRESS — Watson Stillman Press Division, Farrel-Birmingham Co., Inc., Roselle, N. J. Bulletin 371, describing the company's 150-ton general-purpose press. 60

CARBIDE GRADES CHART—Chicago-Latrobe, Chicago, Ill. Chart giving carbide grade recommendations and showing grades and numbers of twelve manufacturers. 65

MOUNTING BRACKETS—M & N Modern Hydraulic Press Co., Inc., Clifton, N. J. Bulletin 5185, describing and illustrating company's mounting brackets. 69

CHAIN COUPLINGS—Morse Chain Co. Industrial Sales Division, Ithaca, N. Y. 16-page catalogue C45-56, giving specifications, dimensions, and ratings for the company's chain couplings.70

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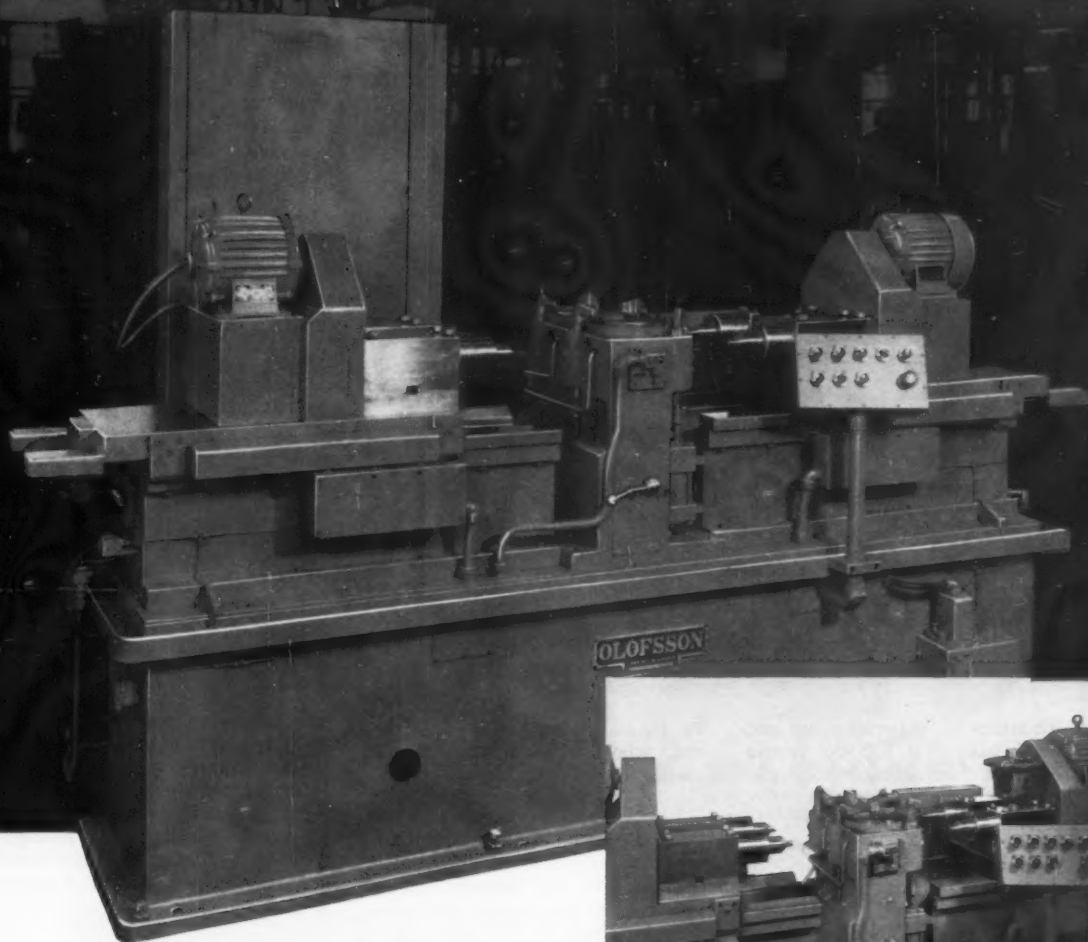
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CATALOGUES														
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TYPE OF MACHINE—Olofsson Two Station Double End Precision Boring Machine arranged with Way Units.

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RATE OF PRODUCTION — 250 cases per hour.

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Hand cycle provides additional retraction of spindles for setting or removal of cutting tools, also independent control of either unit.

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Olofsson Two Station Precision Boring Machine arranged with Way Units. Conforms to J. I. C. electrical and hydraulic standards.

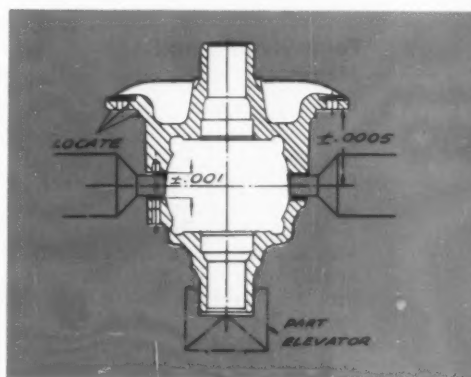


Diagram of differential case clamped in position for simultaneous, double-end precision boring operation.



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R. W. Banfield, president and chief executive officer of the Motch & Merryweather Co.

RICHARD W. BANFIELD has succeeded CHARLES B. LANSING as president and chief executive officer of the Motch & Merryweather Co., Cleveland, Ohio. Mr. Banfield was formerly executive vice-president and director of Niles-Bement-Pond Co.

R. K. LEBLOND MACHINE TOOL Co., Cincinnati, Ohio, has appointed W. ROBERT KOHORST resident sales engineer for the West Coast. Mr. Kohorst has completed ten years' service with the company.

HORTON CHUCK DIVISION, Greenfield Tap & Die Corporation, Windsor Locks, Conn., has named the Ross-Wiloughby Co. distributor in the Columbus, Ohio, area.

Pennsylvania and Maryland

CRUCIBLE STEEL COMPANY OF AMERICA, Pittsburgh, Pa., announces two appointments in its Midland, Pa., works: PAUL R. BRUCKER has been named division metallurgist in charge of flat rolled products and MICHAEL ZETZ division metallurgist in charge of melting and bar products. Mr. Brucker joined the metallurgical laboratory staff at Midland in 1935. Since 1953, he has been staff metallurgist of silicon steels. Mr. Zetz, with the company since 1940, last held the position of general superintendent of the flat products division.

EDWARD C. PETERSON has been elected vice-president, Rolling Mill Equipment Division, Birdsboro Steel Foundry & Machine Co., Birdsboro,



E. C. Peterson, vice-president of Birdsboro's Rolling Mill Equipment Division

Pa. He succeeds EDWARD T. PETERSON, who is continuing with the company as senior engineer.

ROCKWELL MFG. Co.'s Meter and Valve Division, Pittsburgh, Pa., announces promotion of three plant managers—W. M. CONNOR, general manager of the DuBois gas meter plant, has moved to Pittsburgh as assistant to the vice-president; EARL HUDSON, who was named general manager of the Porterville, Calif., plant, succeeds Mr. Connor at DuBois. A. A. FOMILYANT, general manager of the Tulsa, Okla., plant, will assume the general managership of the Porterville plant when it is completed early next year. Until that time, he will remain in charge of both the Tulsa and Porterville plants.

FRANK A. MITCHELL has been named general sales manager for the Henry Disston Division, H. K. Porter Co., Inc., Philadelphia, Pa. Mr. Mitchell will supervise sales activities of the division's hardware, industrial, and export departments.

I. R. LEHENY has been appointed Cleveland district sales manager of the Allegheny Ludlum Steel Corporation, Pittsburgh, Pa. He succeeds W. R. KUHN, who is retiring.

CHARLES A. SHENBERGER has been named general sales manager of the Erie Forge & Steel Corporation, Erie, Pa. He will direct the sales of forgings and steel castings.

E. J. REITLER has been appointed assistant sales manager for Firth-

Loach Metals, Inc., McKeesport, Pa. He will be responsible for sales engineering of blanking dies.

YALE & TOWNE MFG. Co., Philadelphia, Pa., announces plans for the construction of an industrial lift truck sales and service branch in Los Angeles, Calif.

PANGBORN CORPORATION, Hagerstown, Md., has granted exclusive manufacturing and sales rights for its equipment in seven European countries to HEPBURN CONVEYOR Co., LTD., Wakefield, England.

Wisconsin and Minnesota

WARNER ELECTRIC BRAKE & CLUTCH Co., Beloit, Wis., has elected ALONZO A. NEESE to its board of directors, succeeding ELBERT H. NEESE, Sr. Mr. Alonzo A. Neese is also assistant chief engineer and secretary of the Beloit Iron Works and vice-president of the Beloit International Corporation. HARRY BINKS has been promoted to Midwest branch sales manager. RICHARD E. GREENE has been named a representative, with headquarters at St. Louis, Mo.

DUMORE Co., Racine, Wis., has appointed JACK W. WOODARD Southwest manufacturer's representative of automatic drilling equipment.

AMERICAN HOIST & DERRICK Co., St. Paul, Minn., announces these appointments: HILLARD M. PATTON, as manager of the Foundry Division; HARRY A. ANDERSON, as manager of general manufacturing in the St. Paul plant; WALTER R. OLSON, as production control manager of the St. Paul and Fort Wayne plants; and ERNEST S. ECERTSON, as chief industrial engineer of the St. Paul plant.

Obituaries

Joseph W. C. Bullard, Sr.

JOSEPH W. C. BULLARD, SR., retired vice-president and member of the board of directors of the Bullard Co., Bridgeport, Conn., died on September 16 at the age of seventy-four years. Mr. Bullard was the last survivor among five sons of Edward Payson Bullard, founder of the Bullard Co., all of whom devoted their lives to the development of the machine tool manufacturing firm.

(This section continued on page 284)

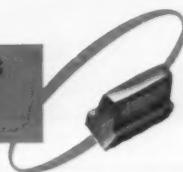
NOISY GEARS ELIMINATED AUTOMATICALLY

A consistent electronic ear in the Red Ring Gear Speeder has replaced the human sense of hearing which, as we know, varies with the fatigue and mental attitude of the listener.

This electronic sound discriminator is readily adjusted to reject gears at any point within the range of audible noise frequency and intensity.

The Model GSR Speeder for gears and pinions in the smaller sizes is fully automatic. Gears are loaded, run in both directions, with and without a brake load and are either passed or rejected by the electronic sound discriminator as a continuous operation. *Write for Details.*

SPUR AND HELICAL GEAR SPECIALISTS
ORIGINATORS OF ROTARY SHAVING
AND ELLIPTOID TOOTH FORM

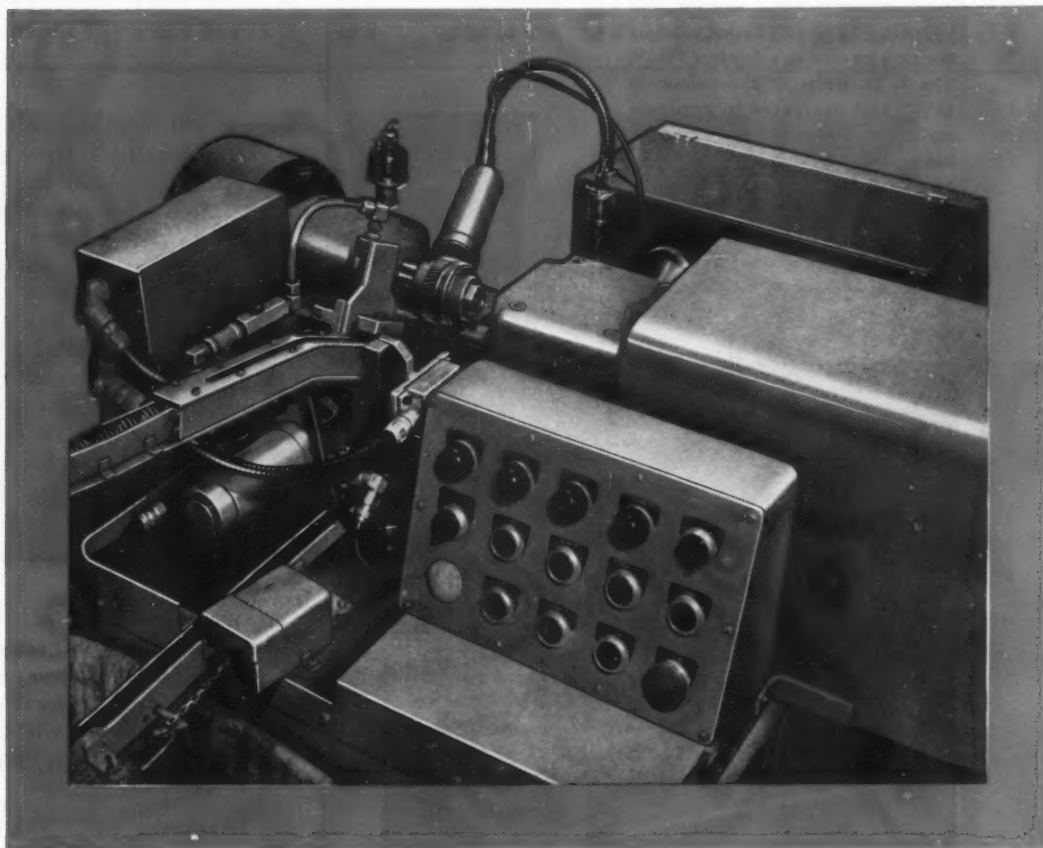


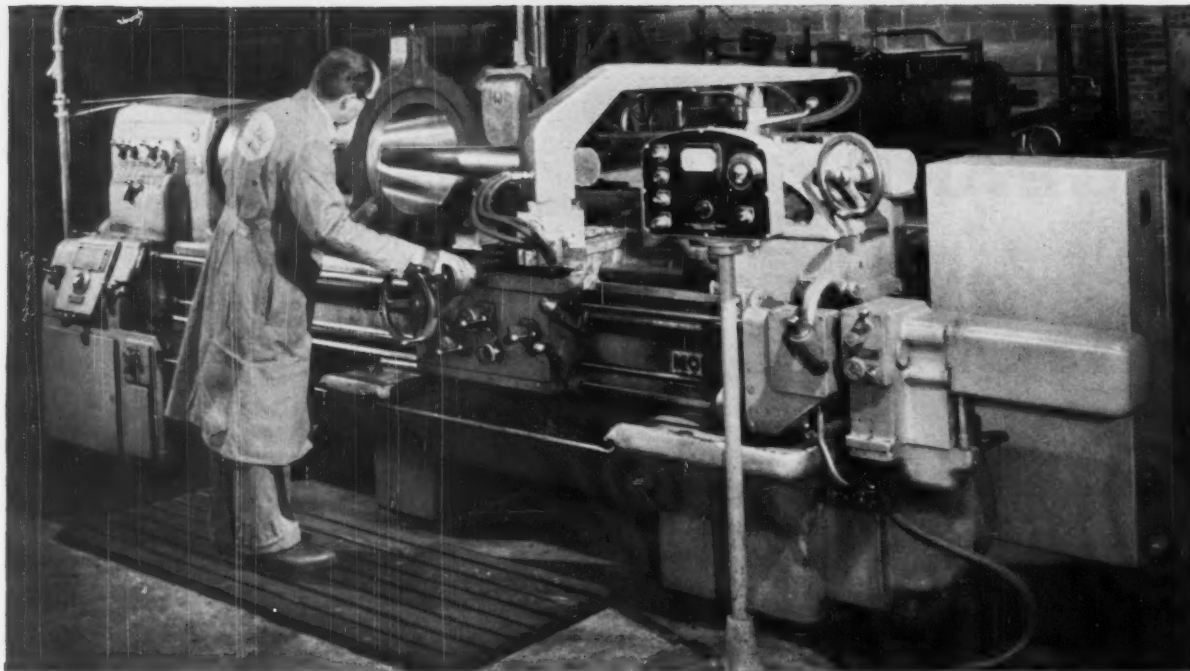
NATIONAL BROACH & MACHINE CO.

5600 ST. JEAN • DETROIT 13, MICHIGAN

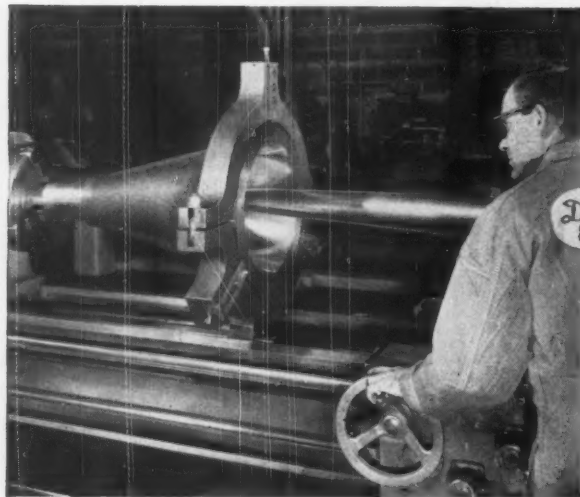
WORLD'S LARGEST PRODUCER OF GEAR SHAVING EQUIPMENT

7547





A Monarch 20" Series 61 Swiveling "Air-Gage Tracer" Lathe contour boring a jet cone to a depth of $31\frac{1}{2}$ ". The I. D. starts at approximately $18\frac{1}{2}$ " and decreases to approximately 4". The contour of the I. D. has a radius and blend tapers. Material is the tough super-alloy called A-286, one of the toughest of all the new super-alloys to machine. "Some jobs", says Diversey's president, "can only be done on Monarch swiveling-type tracer lathes".



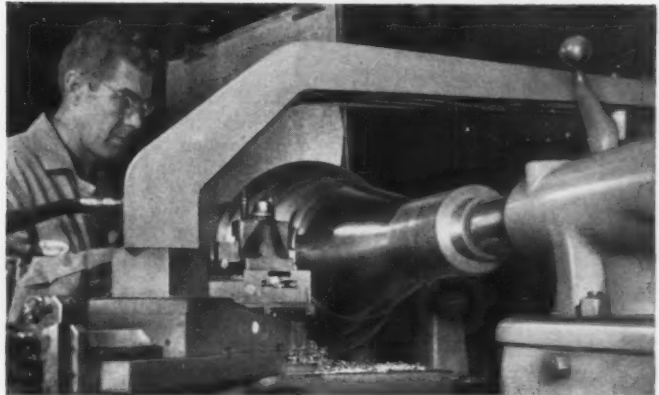
Hitch up the talents of DIVERSEY ENGINEERING COMPANY, Franklin Park, Illinois and their tracer-controlled Monarch lathes, and you get one of the most important production teams in our jet engine and guided missile programs.

Starting with one Monarch lathe seven years ago, Diversey is now the largest in the country specializing in these components. Fifteen lathes—an exclusively Monarch installation—are now in practically around-the-clock use. All but two are tracer-controlled. Latest is a 48" swing swiveling Air-Gage Tracer type machine, the capacity of which places Diversey in the position of being one of the few companies in the United States with the equipment and know-how to handle machining on some of the large, new guided missile contoured parts.

Monarch's tracer controlled lathes are more than the Secret Weapon's secret weapon—they're everybody's weapon for better production. Yours too! Ask for Booklet #2608 —or a sales engineer . . . The Monarch Machine Tool Company, Sidney, Ohio.



The same Series 61 turns the same jet cone, described on opposite page. This operation uses practically the full swing capacity of the lathe.



"GUIDED" LATHES for Guided Missiles Contour Turning of "Super-alloys" Made Easy



A Monarch 20" Model M "Air-Gage Tracer" Lathe finish machines the center bulkhead of a guided missile to 63RMS. Material is heat-treated hi-nickel alloy. In the foreground of above illustration is a number of completed bulkheads while toward the tail end of the machine are some nose cones for a missile head. These are also turned on the 20" Model M. Smaller view (above right) shows clearly the unusual finish imparted.



Monarch
TURNING MACHINES

FOR A BETTER TURN FASTER
... TURN TO MONARCH



Joseph W. C. Bullard, Sr.

At the time of his retirement from the company in 1947, Mr. Bullard was vice-president in charge of research. He had been a member of the board of directors since 1917. He is survived by his wife, Mrs. Susan Davis Bullard; a daughter, Mrs. Richard Hall; two sons, W. C. Jr., and Robinson D.; and five grandchildren.

John Addison Brandon

JOHN ADDISON BRANDON of Vancouver, British Columbia, who had been a member of The Industrial Press subscription selling staff in Canada since 1932, died suddenly of a heart attack on September 17.

Mr. Brandon represented both MACHINERY and AIR CONDITIONING, HEATING AND VENTILATING, as well as The Industrial Press line of engineering books. Prior to joining the company, Mr. Brandon was active in real estate.



John Addison Brandon

ANTHONY W. TAYLOR, director of purchases for the Crucible Steel Company of America, Pittsburgh, Pa., died on September 15 at the age of fifty-six years.

JOSEPH M. SCHAEFFER, president of the Waterbury Farrel Foundry & Machine Co., Waterbury, Conn., died on September 7 at the age of seventy-one years.

Coming Event

NOVEMBER 26-30—TWENTY-SECOND NATIONAL EXPOSITION OF POWER AND MECHANICAL ENGINEERING under the auspices of THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS to be held at the New York City Coliseum.

New Books and Publications

CAMS: DESIGN, DYNAMICS, AND ACCURACY. By Harold A. Rothbart, 350 pages, 6 by 9 inches. Published by John Wiley & Sons, Inc., 440 Fourth Ave., New York 16, N.Y. Price, \$9.50.

This book offers up-to-date treatment of dynamics and machine design using cams as a basis. It represents a significant extension of the usual kinematic approach to cam action. Lucid coverage of both the theoretical and practical aspects of the subject is given. There are complete recommendations concerning such topics as mass, acceleration, materials, and the type of cam and follower to be used. Of special interest is the discussion of profile accuracy and errors.

NATIONAL STANDARDS IN A MODERN ECONOMY. By Dickson Reck. 372 pages, 6 by 9 inches. Published by Harper & Bros., 49 E. 33rd St., New York 16, N.Y. Price, \$5.

This book is both a review of the evolution of standards and the evaluation of their place in the world today. Standards are basic components of many aspects of modern life, including scientific research, technological innovation, engineering advance in the era of automation, economical use of resources, and effective protection of seller, buyer, producer, and consumer. Both national and international standards, governmental and voluntary, are discussed in this survey.

SYMPOSIUM ON IMPACT TESTING. 170 pages, 6 by 9 inches. Published by the American Society for Testing Materials, 1916 Race St., Philadelphia, Pa. Price, \$3.50.

This book, based on a symposium sponsored by Committee E-1 on methods of testing, presents papers discussing impact and shock tests for parts, components, and complete

structures. Additional papers considered timely and appropriate to the subject are included. Innovations such as the impact tube are discussed, and environmental conditions, particularly temperature, are considered.

MECHANICAL VIBRATIONS. By J. P. Den Hartog. 436 pages, 6 by 9 inches. Published by McGraw-Hill Book Co., 330 W. 42nd St., New York 36, N.Y. Price, \$9.

This book is intended for engineering students after the usual first courses in statics, dynamics, and strength of materials. The latter half of the book can be used for graduate students.

While dealing with vibration phenomena, descriptions are given of many applications of principles and calculations and practical vibration problems encountered by the practicing engineer. Complete explanations and proofs are given.

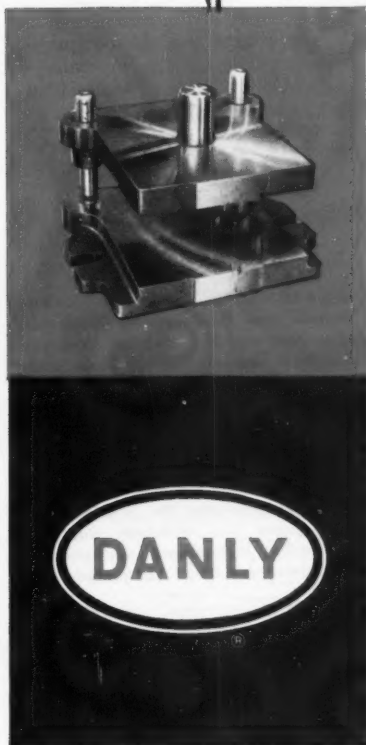
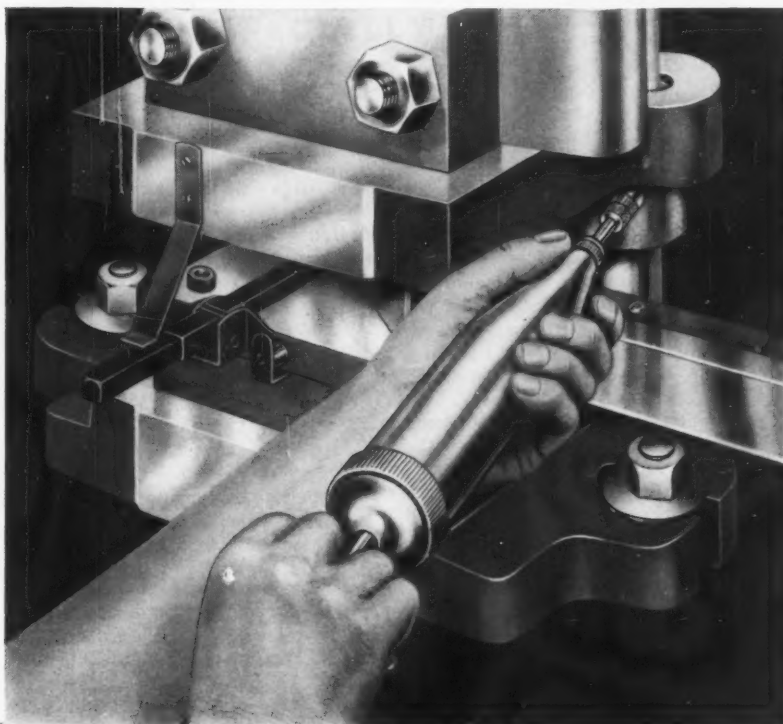
RESISTANCE WELDING: THEORY AND USE. Prepared by Resistance Welding Committee, American Welding Society. 163 pages, 6 by 9 inches. Published by Reinhold Publishing Corporation, 430 Park Ave., New York 22, N.Y. Price, \$4.50.

Every aspect of resistance welding from basic principles to most effective uses is presented by outstanding authorities on the subject. Newest developments such as slope control and the welding of aluminum receive full attention.

THE AMERICAN WORKERS' FACT BOOK. United States Department of Labor. 433 pages, 6 by 9 inches. Published by the Government Printing Office, Washington 25, D.C. Price, \$1.50.

A compendium of information on workers in the United States consisting of 138 brief topics written in simple style.

NEW oil lubrication system



ON NEW DANLY DIE SETS

Here is another example of Danly leadership in die set design . . . the new oil lubrication system for guide posts and bushings. The illustration shows how easily a lubrication gun reaches the oil fitting in the shoulder of the bushing. Once injected, oil fills figure-8 oil grooves in the bushing to assure uniform lubrication for protection that lasts even through long press runs . . . less frequent oiling is needed, the job is done faster. Isn't this new lubrication system another important reason why you should specify Danly die sets?



complete new "leadership line" catalog

More than 200 pages provide you with more complete design information, easier selection of die sets and supplies. Write for your copy today!

DANLY MACHINE SPECIALTIES, INC.

2100 South Laramie Avenue • Chicago 50 • Illinois

REVIEWS OF AVAILABLE MOTION PICTURES

FLAW LOCATION WITH DYE PENETRANTS

Every aspect of dye penetrant inspections from laboratory theory to authentic production-line techniques is demonstrated in a color and sound 16-millimeter movie entitled "Flaw Location with Dye Penetrants." Available for free showing to industrial concerns, technical groups, and other interested organizations, the twenty-three-minute film may be secured by writing to Turco Products, Inc., 6135 S. Central Ave., Los Angeles 1, Calif.

ELECTROSTATIC SPRAY PAINTING

A thirty-minute, 16-millimeter, color and sound industrial film entitled "The Big Attraction" is available upon request to the Ransburg Electro-Coating Corporation, Barth and Sander Sts., Indianapolis, Ind. The film first describes electrostatic paint spraying and then takes the viewer on a tour of industrial plants using the process. The film was prepared primarily for those interested in production-line painting operations.

PRESSES

Five new color and sound motion pictures are illustrated and described in a four-page leaflet being distributed by the E. W. Bliss Co. Subjects of the films include "Power Press Maintenance," the company's one-thousandth transfer feed press, "Transfer Feed Presses in the Appliance Industry," the No. 1831

high-speed strip-fed press, and "The Bliss-Crary Tonnage Limiter." Information for securing copies of the films for showings to plant personnel is given in the leaflet, which is available by writing to the company at Canton, Ohio.

WIRE ROPE MANUFACTURING PROCESS

"Quality Unlimited," a thirty-minute sound-color film describing the manufacture of wire rope, is obtainable from the Wickwire Spencer Steel Division of the Colorado Fuel & Iron Corporation. Special emphasis is given to the chemical and physical tests that accompany every step in the manufacturing process. Applications and proper care of wire rope are also illustrated. For further information write to the Colorado Fuel & Iron Corporation, 575 Madison Ave., New York 22, N. Y.

AUTOMATED PRESS LINE

"Transflex—Automation in Action," a 16-millimeter color and sound film produced by the Clearing Machine Corporation, describes an automated press line which produces automotive wheels. The twenty-two-minute film shows the construction of the feed mechanism, the operation of the press line, and the significance of the Transflex concept of press design. This film may be obtained by writing the Clearing Machine Corporation, c/o U. S. Industries, Inc., 6201 W. 63rd St., Chicago 38, Ill.

Free Course in Methods for Shop Inspection of Gage-Blocks

As an educational service to industry, the DoALL Technical Institute, Des Plaines, Ill., is offering a free, four-day course on shop inspection and testing of gage-blocks. The program entitled "How to be Your Own Bureau of Standards" includes both classroom sessions and laboratory practice. Approved by the National Bureau of Standards, this course is open to companies using gage-blocks.

Each trainee is requested to bring a set of his company's gage-blocks which he will inspect and calibrate as part of his instruction. Classroom sessions are concerned with subjects including interferometry, dimensional controls, calibration records, temperature effects, and observational errors. In the laboratory, actual procedures, operation of instruments, and recommended calibration methods are practiced.

Since gage-blocks can now be calibrated and inspected for wear with only a few items of simple equipment and without expensive air-conditioning facilities, even the smallest companies can maintain their own master gages.

Concerns desiring enrollment information or further details about the program should write to the company. A manual under the same title as the course, giving information on the procedures and the equipment required to set up a program of gage-block inspection and calibration, is also available.



Making SR-4 strain gages at the Baldwin-Lima-Hamilton Corporation's Electronics and Instrumentation Division, Waltham, Mass. Now housed in a brand-new plant, the Division previously functioned as Ruge deForest, Inc., of Cambridge, Mass.; O. S. Peters Co., of Washington, D. C.; Sonntag Scientific Corporation, of Greenwich, Conn.; and the Testing Equipment Department of the B-L-H Eddystone Division, of Philadelphia, Pa. In addition to strain gages, the Waltham plant will make testing instruments, machines, systems, and allied equipment.

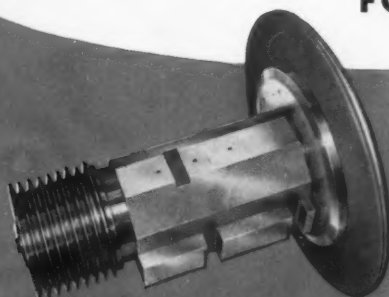
There's an EX-CELL-O

Precision Spindle

**BUILT ESPECIALLY
FOR YOUR WORK**



Single-body, belt-driven internal grinding spindle.



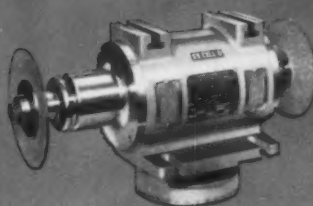
25 hp heavy duty precision spindle with 24" grinding wheel.



25,000 rpm high frequency inbuilt motor spindle.

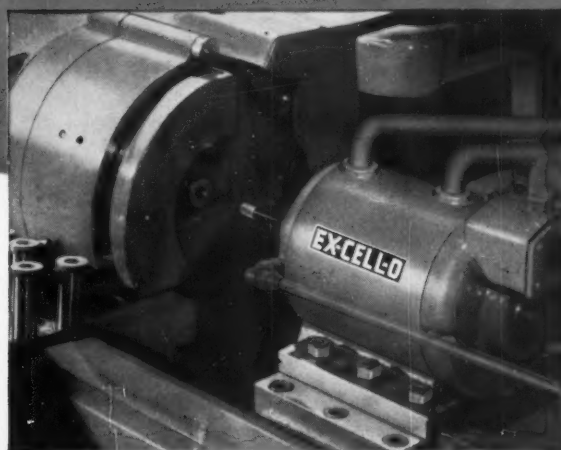
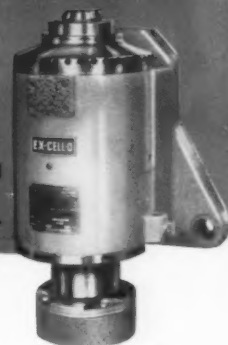


Totally enclosed inbuilt motor surface grinder spindle.



Precision inbuilt motor spindle for cutter grinder.

Heavy duty motorized precision spindle available up to 20 hp.



EX-CELL-O High-frequency Spindle, rated at 40,000 rpm, grinds small holes in bushings.



For production grinding to precision limits "just any spindle" won't do. It must be carefully selected to suit the work. From Ex-Cell-O's widely-varied line of precision spindles you can select a standard model, or we'll make one special to your requirements. These spindles have long been the original equipment choice of leading manufacturers.

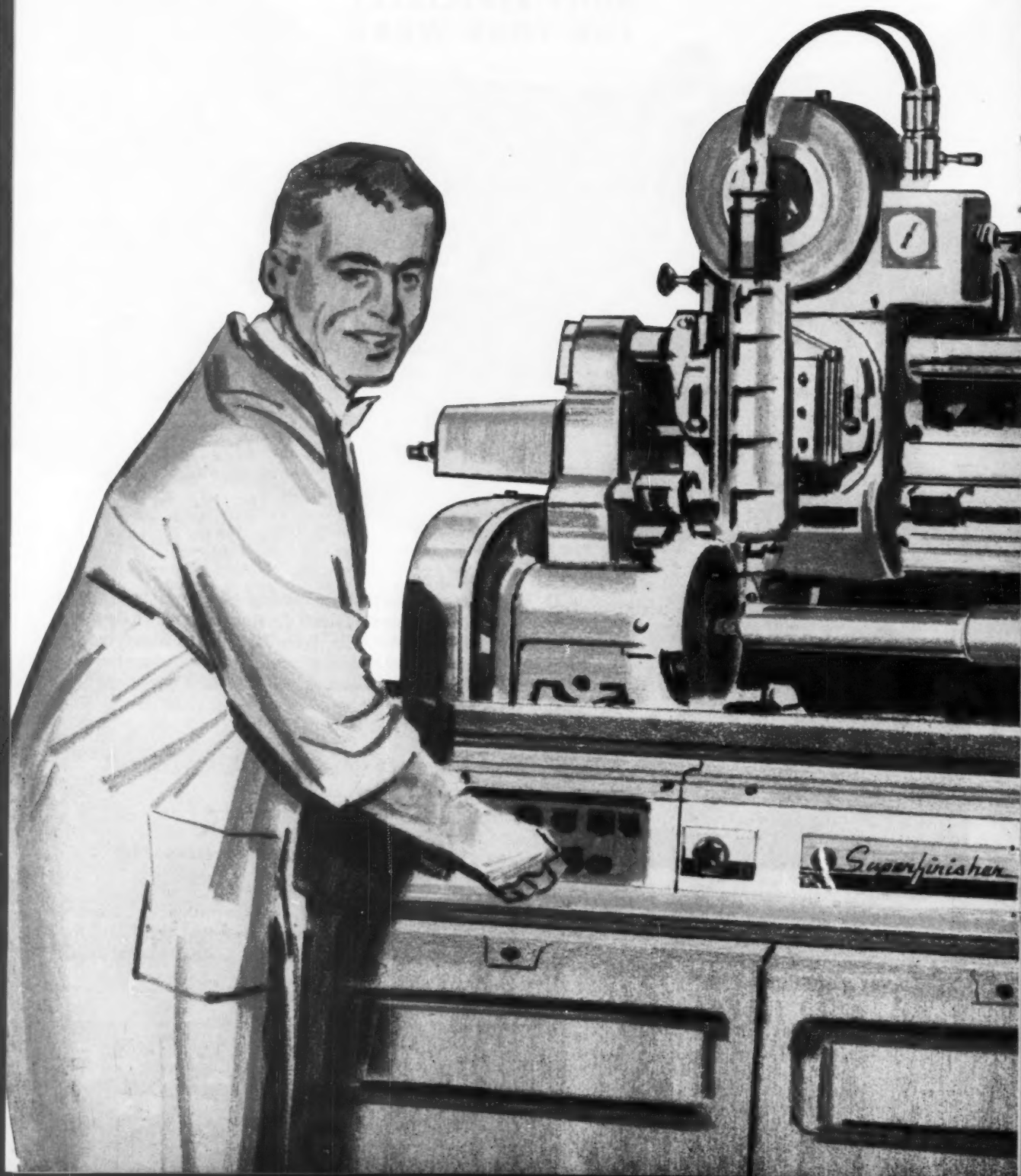
Features of the line include:

Rigidity
Permanent adjustment
No vibration, no chatter
Precision ball bearings preloaded for predetermined speeds

Phone your Ex-Cell-O representative, or phone or write Ex-Cell-O in Detroit, for CATALOG LISTING HUNDREDS OF STANDARD GRINDING SPINDLES

MANUFACTURERS OF PRECISION MACHINE TOOLS • GRINDING SPINDLES • CUTTING TOOLS • RAILROAD PINS AND BUSHINGS • DRILL JIG BUSHINGS • AIRCRAFT AND MISCELLANEOUS PRODUCTION PARTS • DAIRY EQUIPMENT

EX-CELL-O
CORPORATION
DETROIT 32, MICHIGAN

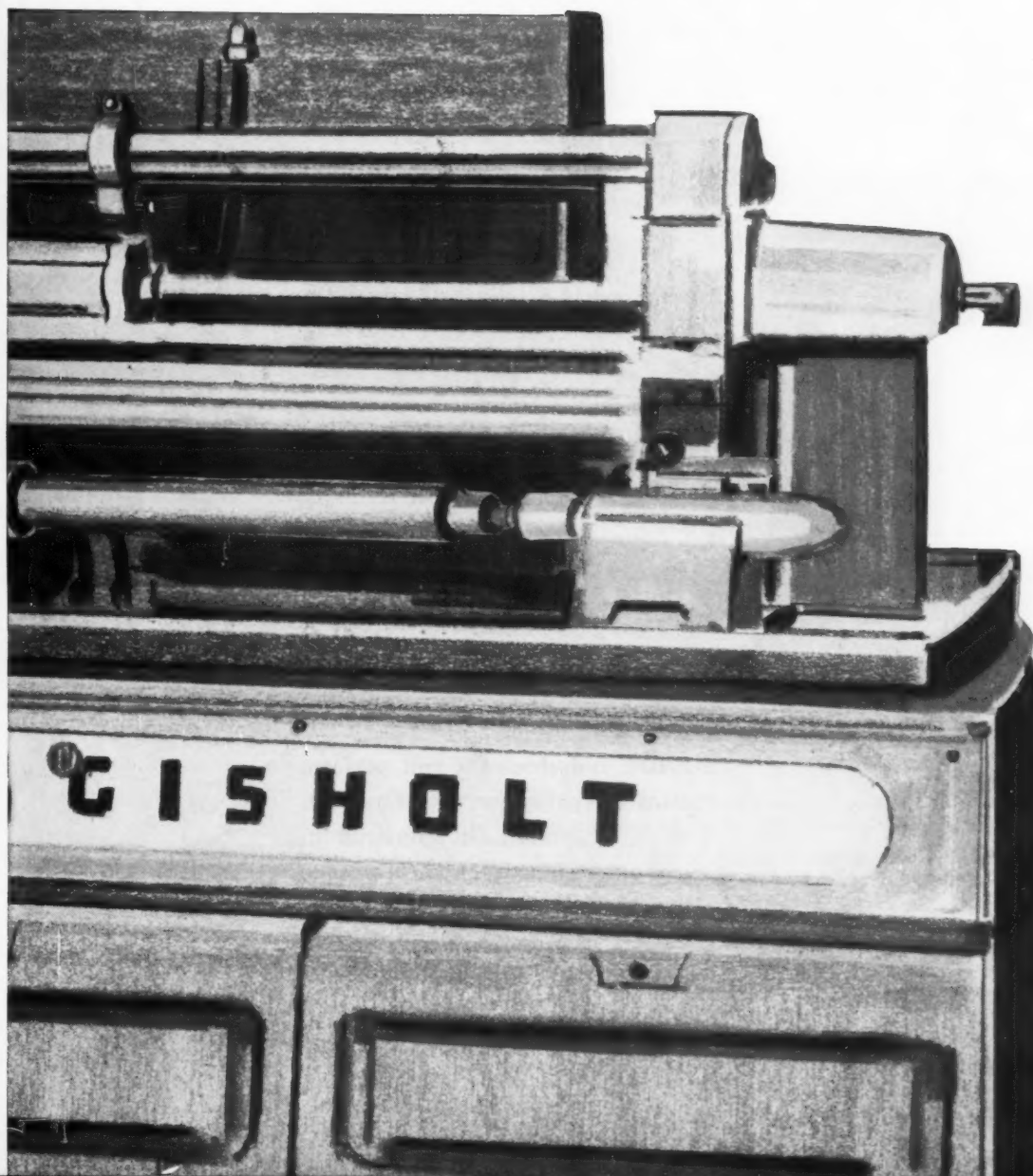


GISHOLT MASTERLINE 52A SUPERFINISHER



The Superfinishing process is recognized as one of the most important contributions to modern metalworking. Now—in this new 52A MASTERLINE Superfinisher—Gisholt offers an outstanding machine for either small job-lot work or high production runs. Other general purpose and high production models complete the line. Let us give you the complete facts on how Superfinishing may be profitably applied to your manufacturing processes—plus full details on the complete line of Gisholt Superfinishing Machines.

Gisholt Machine Company, Madison 10, Wisconsin
Look ahead—keep ahead—with Gisholt





"We have no operating problems

*Midwest Metal Stamping
reports results of 8 years of
press operation using STANOIL*

In 1948, Midwest Metal Stamping Company, Kellogg, Iowa, put into service a Bliss Hydro Dynamic Press. STANOIL Industrial Oil was selected as the hydraulic medium. The initial fill was 1,400 gallons. The press operated continuously from 1948 until Christmas, 1954, when it was shut down five days for overhaul.

At the time of overhaul, the STANOIL Industrial Oil was drained. And here STANOIL's superior demulsibility was demonstrated. Due to the high rate of condensation, two barrels of water were removed from oil reservoir. An oil analysis in the Standard Oil laboratory proved the oil still suitable for continued service. After filtration, it was returned to the reservoir and the press put back in operation. STANOIL continues to deliver the same perfect performance for Midwest as before.

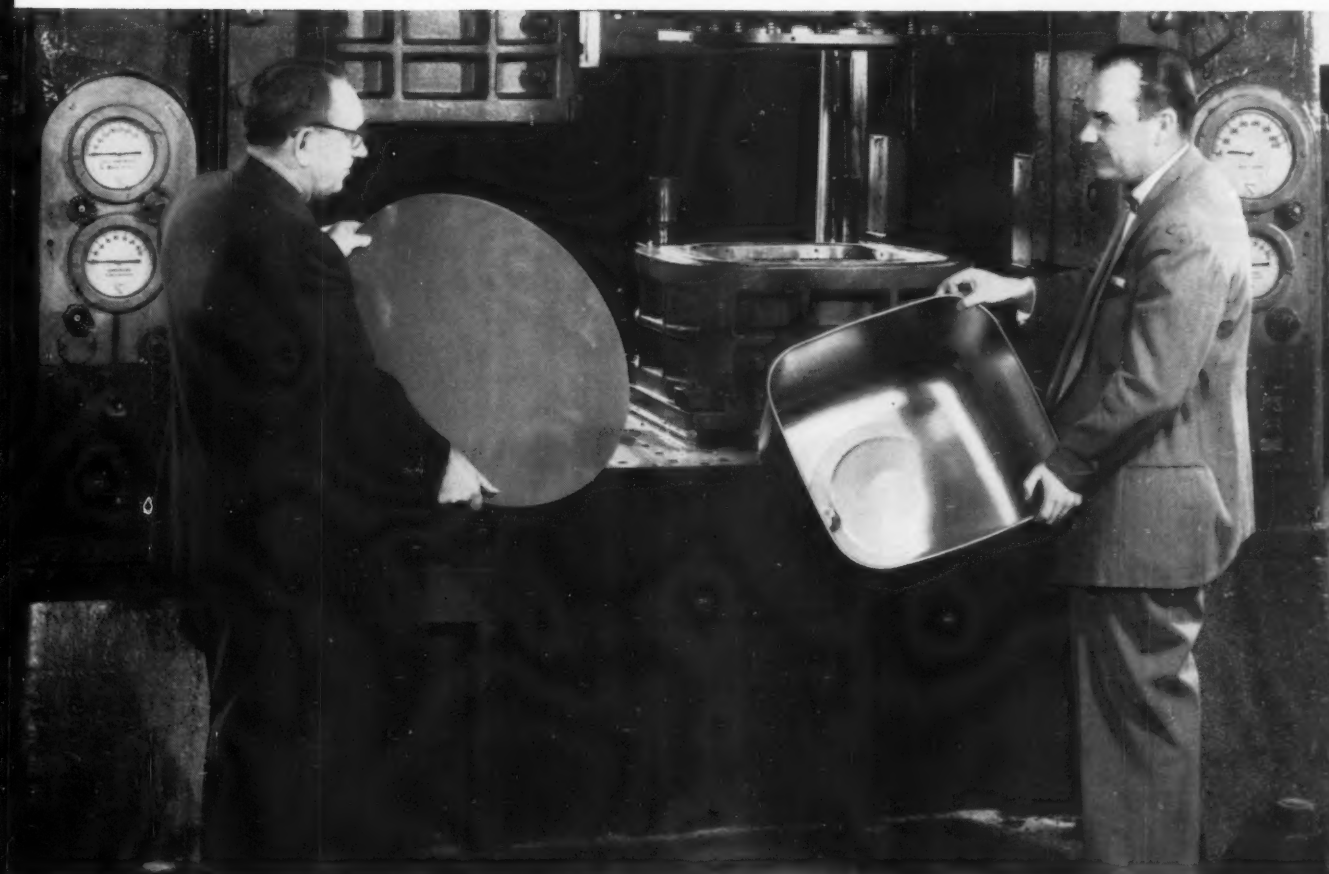
STANOIL Industrial Oil can perform just as efficiently for you. Find out. There is a Standard Oil industrial lubrication specialist near you in any one of the Midwest and Rocky Mountain states. Call him. Or write Standard Oil Company, 910 South Michigan Ave., Chicago 80, Illinois.



Stamping being removed from press by operator George Johnson. Press has used STANOIL Industrial Oil as hydraulic medium for eight years. Oil has perfect performance record.

when we use **STANOIL Industrial Oil**"

Don Foster, Midwest Stamping Purchasing Agent and Jesse Nelson (right), Standard Oil industrial lubrication specialist, display metal blank and finished tub turned out on Bliss press. Technical service on lubrication problems is Jesse Nelson's job. He's been doing such work for seven years. Jesse has an engineering degree from the University of Iowa and is a graduate of the Standard Oil Sales Engineering School. Customers find this experience and training pay off for them.

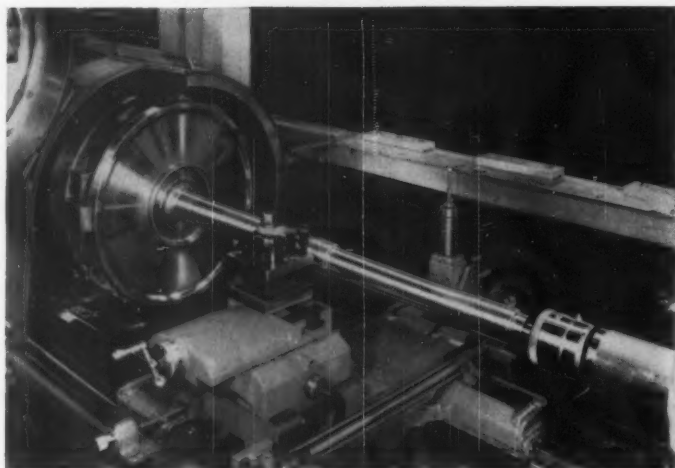


Quick facts about **STANOIL Industrial Oil**



STANDARD OIL COMPANY
(Indiana)

- Special refining and an additive, exclusive with STANOIL, make this industrial oil resistant to chemical change.
- In all grades of STANOIL that need it, an advanced type corrosion inhibitor is added. Inhibitor "plates out" on metal surfaces, prevents rust.
- Selective refining and special additives give STANOIL low pour point. STANOIL flows freely at low temperatures.
- High viscosity index of STANOIL is indication of the oil's ability to resist change at any operating temperature.
- No foam, no emulsion with STANOIL. STANOIL's special additive and selective refining minimize or eliminate these oil problems.
- Low carbon forming tendencies of STANOIL reduce or eliminate this problem.



Now

handle jobs
impossible on a
conventional
tracer lathe . . .

with the **LODGE & SHIPLEY**

DUAL TRACER

Lathe and All-Hydraulic 360° Control

DUAL TRACER Lathe in plant of famous auto manufacturer turns all shaft diameters on a hub assembly for a turbine rotor. Machining time on this 5 1/4" x 4" diameter part is only 22.5 minutes. Also used to face both sides of the hub portion of this part.

On many types of work, conventional tracer lathes are limited in their ability to handle complex jobs. The Lodge & Shipley DUAL TRACER Lathe is a significant advance. It is designed to speed and simplify the duplication of complex curves on a lathe which can also be instantly changed over to standard lathe operation.

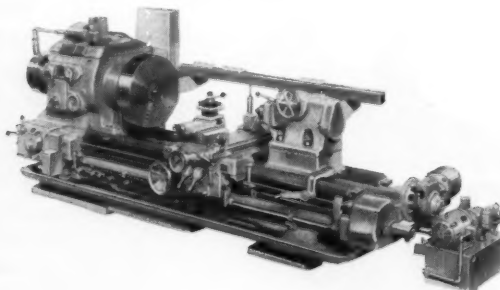
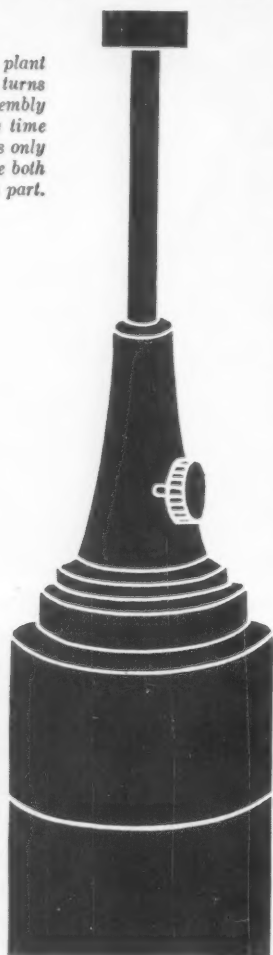
The most important application of the DUAL TRACER is in the machining of complex contours on the periphery, bore or face of a component.

Reduced to its basic elements, the DUAL TRACER Lathe consists of two (or dual) hydraulic motors controlled by the tracing stylus. One motor controls the rotation of the cross feed screw and hence the "in and out" movement of the cutting tool or tools. The other motor controls the rotation of the lead screw and hence the movement of the carriage along the ways.

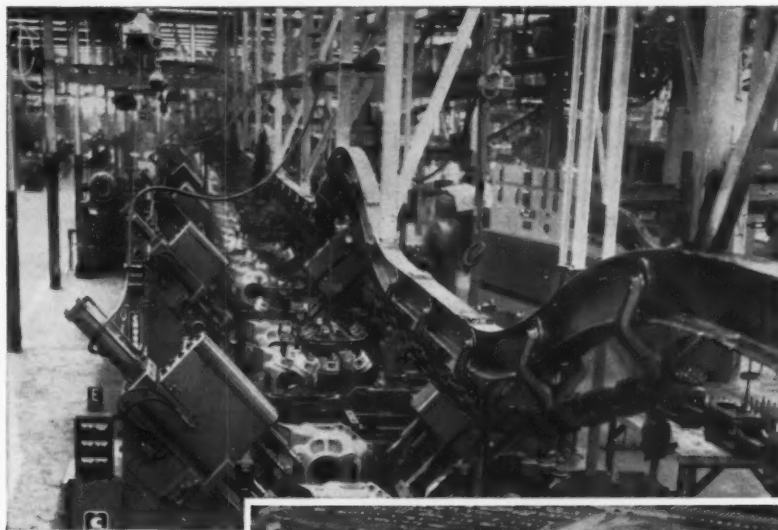
Chances are the DUAL TRACER can do your job faster and more economically. Consult our sales engineering department. For details, write: The Lodge & Shipley Co., 3055 Cole-rain Ave., Cincinnati 25 Ohio.

**Built by
LODGE & SHIPLEY**

- LATHES
- HYDRAULIC PRESSES
- PRESS BRAKES
- SQUARING SHEARS
- FLOTURN MACHINES



In the Spectacular PLYMOUTH ENGINE PLANT you see



(Above) View of Plymouth
Engine assembly line



VICKERS

HYDRAULICS

*Wherever
You Look*

Plymouth Engine Plant is 980' long and 500' wide. Indicative of its scope is crankshaft machining requiring 4500 linear feet of automation composed of 385 individual units. Plant capacity is 150 engines per hour.

In the new Plymouth "Qualimatic" Engine plant you see Vickers Hydraulics on every side. Hundreds of machines in this latest and greatest example of automation are Vickers equipped.

Both builders and users of production equipment appreciate the significant advantages of Vickers Hydraulics . . . advantages that help produce better products at lower cost.

A specific need in the Engine Plant is standardization on a few basic hydraulic units to keep down parts inventories. The Vickers line makes standardization easy. Also desirable are hydraulics in units quickly demountable . . . so that by replacing units, repairs on the job are avoided and costly downtime reduced. Vickers has extensively developed demountable unit construction.

Whether automated or not, more and more plants have more and more Vickers Hydraulics. For further information, write for Catalog 5002B.

VICKERS HYDRAULICS is used on machines supplied by these Companies to Plymouth Engine Plant

American Broach & Machine Co.	Lees-Bradner Company
Barnes Drill Company	Michigan Drill Head Co.
Bilt-Rite Tool & Machine Co.	Micromatic Hone Corporation
Buhr Machine Tool Company	Micro-Poise Engineering & Sales Co.
Colonial Broach & Machine Co.	Modern Industrial Engineering Co.
Crankshaft Machine Company	The Mott & Merryweather Machinery Co.
The Cross Company	Norton Company
Ex-Cell-O Corporation	A. P. Schramm Co.
Fitchburg Engineering Corp.	The Sheffield Corporation
Greenlee Bros. & Company	Snyder Tool & Engineering Co.
Industrial Metal Products	Sundstrand Machine Tool Co.
The LaPointe Machine Tool Co.	Jervis B. Webb Co.
Landis Tool Company	The Wickes Corp.
The R. K. LeBlond Machine Tool Co.	Wilson Automation Co.

VICKERS INCORPORATED

DIVISION OF SPERRY RAND CORPORATION

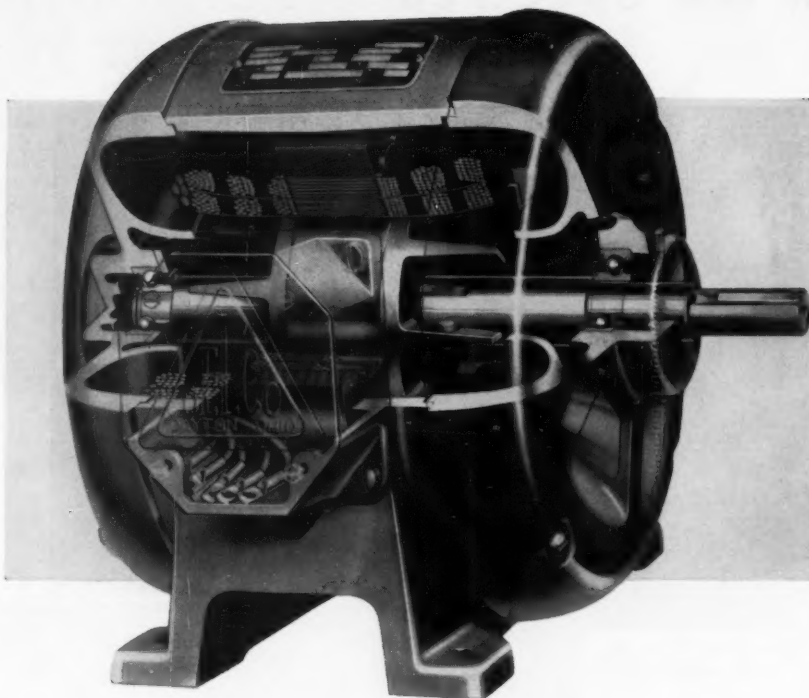
ADMINISTRATIVE and ENGINEERING CENTER

Department 1403 • Detroit 32, Michigan

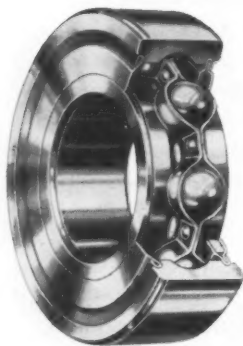
ENGINEERS AND BUILDERS OF OIL HYDRAULIC EQUIPMENT SINCE 1921

Application Engineering Offices: • ATLANTA • CHICAGO • CINCINNATI • CLEVELAND
DETROIT • GRAND RAPIDS • HOUSTON • LOS ANGELES AREA (El Segundo) • MINNEAPOLIS
NEW YORK AREA (Summit, N.J.) • PHILADELPHIA AREA (Media) • PITTSBURGH AREA
(Mt. Lebanon) • PORTLAND, ORE. • ROCHESTER • ROCKFORD • SAN FRANCISCO
AREA (Berkeley) • SEATTLE • ST. LOUIS • TULSA • WASHINGTON • WORCESTER
IN CANADA: Vickers-Sperry of Canada, Ltd., Toronto

7545



BALL BEARINGS CUT LUBRICATION MAINTENANCE TO VIRTUALLY ZERO



Precision-made New Departure ball bearings assure permanently accurate support of the rotor shaft under all load conditions and mounting positions, plus cool-running, quiet bearings at all speeds.

In normal operation, New Departure sealed and shielded bearings reduce lubricating requirements to virtually zero. Built-in seals on the inside faces prevent grease leakage *into* the motor. Metal shields at the outer faces keep foreign matter *out* of the bearings while permitting entry of just the right amount of grease from the end bell for perfect bearing operation. Overheating from excessive lubrication can't occur.

Join the leaders who look to New Departure for bearings and engineering service in product development and improvement. New Departure, Division of General Motors, Bristol, Connecticut.

BALL BEARINGS MAKE GOOD PRODUCTS BETTER

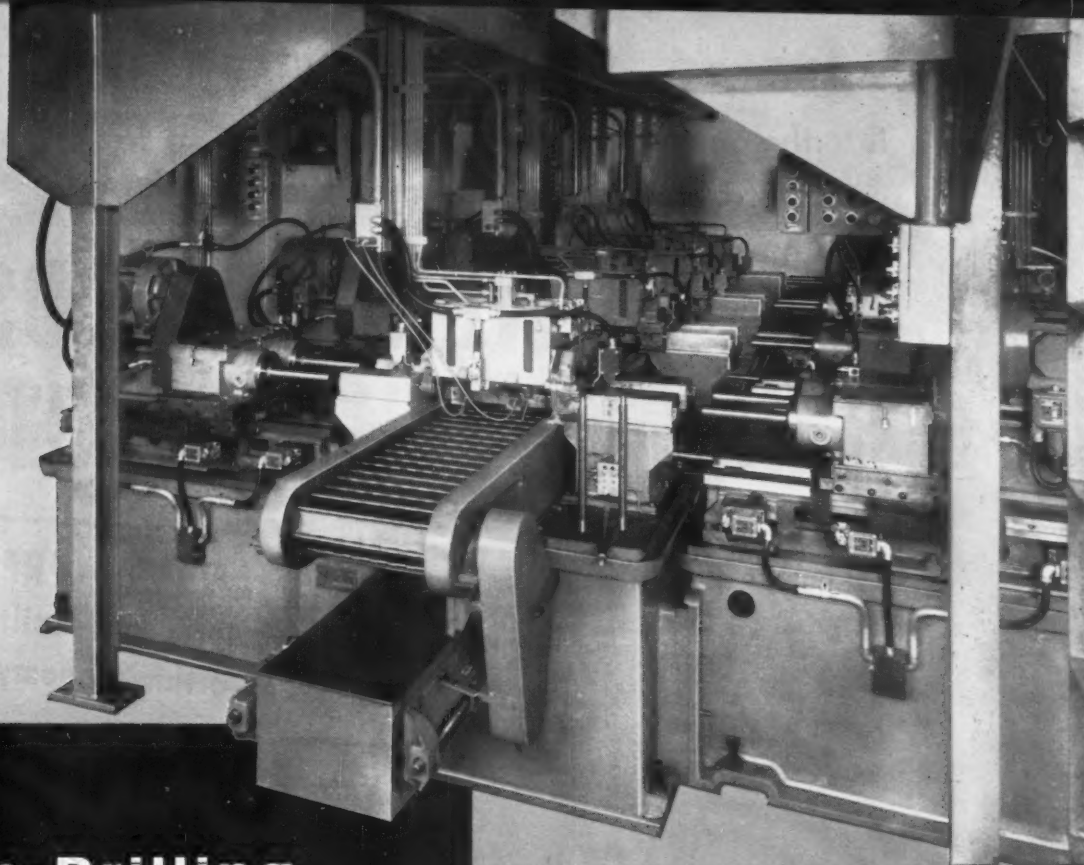
SEE "WIDE WIDE WORLD"
SUNDAYS—NBC-TV

NEW DEPARTURE
BALL BEARINGS



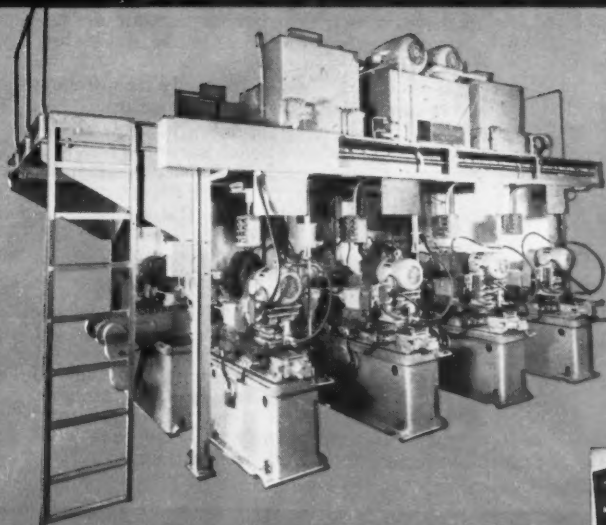
NOTHING ROLLS LIKE A BALL

KB



Gun-Drilling from both ends

An automatic cut-off element controls each piece. Should drills become dull causing over-heating, machine stops. Each double unit operates independently—insures continued production.



Operator loads hopper manually. Parts pass from hopper to fixtures two-at-a-time. Parts transfer out of machine automatically.

This new Gun-Drilling Machine puts a precision .281" hole through 14" length of Turbine input shafts. Two drills operate simultaneously. Controls are electrically interlocked; drill #1 withdraws within 1/2" of meeting point; #2 completes the hole and withdraws. Each of the four stations handle two pieces (16 gun drills in use) . . . Production: 173 gross pieces per hour.



This booklet, showing Krueger-Barnes special machine applications will be sent immediately on request.

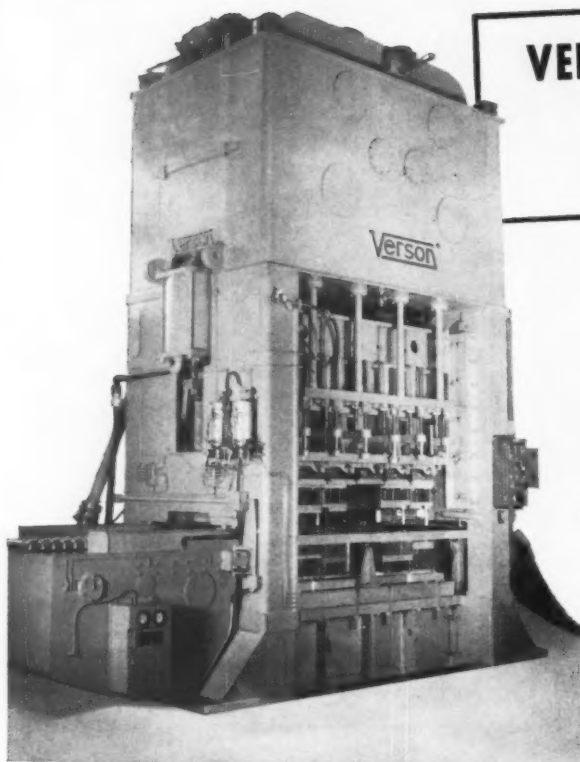
KRUEGER-BARNES CORPORATION

1469 E. GRAND BLVD., DETROIT 11, MICHIGAN

DESIGNERS AND BUILDERS OF HIGH PRODUCTION MACHINE TOOLS

There is only one primary reason
for buying a Transmat press . . .

LOWER UNIT COSTS WHERE PRODUCTION



VERSON TRANSMAT PRESSES
are engineered and built
to give you this economy

If you produce any part requiring four or more operations on 4000 or more pieces per day, Verson Transmat Presses offer remarkable opportunities for cost reduction.

The Verson Transmat is designed and built solely for the purpose of producing multi-operation stampings at the lowest possible cost. Design is not compromised in any way that will affect this objective! As a result Verson Transmats offer a combination of advantages available in no other transfer press—

- High speed—20, 25 and even 36 strokes per minute with machines having capacities up to 4000 tons.
- Positive, direct, gear driven transfer mechanism with safety interlocks make misfeeding impossible.
- Non-oscillating feed bars, only the fingers move in and out—fast, smooth action.
- Automatic, delayed action, adjustable stroke knockout cylinders at each station—prevents damage to piecepart by positive stripping and location.
- Individual adjustable wedge slides for precise die adjustment.
- Fully automatic lubrication—two Cascade oil flow systems and two pressure systems.

When you buy a transfer press be sure you get the high production you are paying for. Be sure you get the efficient, trouble-free operation that Verson know-how assures you. Described at the right are a few of the jobs being performed successfully at this moment. We'll be happy to tell you about others . . . and we'll welcome the opportunity to show you what Transmats can do for you. Write or phone.

TYPICAL 500 TON VERSON TRANSMAT—This is the press that produces the valve covers described at the right. Today's Verson Transmat is the culmination of twenty years of specific development of an automatic process to produce multiple operation stampings. Since the installation of the first Transmat eighteen years ago,* the machine has progressed to the point where there is no limit to tonnage capacity or size of piecepart that can be produced. Transmats as small as 100 tons and as large as 4000 tons have been built.

*Still in service, producing 1300 oil filter shells per hour.

ORIGINATORS AND PIONEERS OF ALLSTEEL STAMPING PRESS CONSTRUCTION



VERSON ALLSTEEL

9309 S. Kenwood Avenue, Chicago 19, Illinois

MECHANICAL AND HYDRAULIC PRESSES • TOOLING • TRANSMAT

ON JOBS REQUIREMENTS ARE HIGH

Here's Proof

of what VERNON TRANSMATS can do

These are verified production figures of a few of the Transmats in use in metalworking plants at this moment.



20 3/8" x 3 5/8" x 2 3/4"—18 ga. stock.

1,200 VALVE COVERS PER HOUR

Five operations on each, a total of 6,000 press operations per hour. The part is formed from strip. Two such presses are currently in operation, both since 1954.



5" diam. x 2 1/4"—16 ga. stock.

1,500 MOTOR HOUSINGS PER HOUR

Ten operations on each, a total of 15,000 press operations per hour. The part is formed from strip. One 600 ton Transmat has been in operation for over one year.



7" diam. x 4"—20 ga. stock.

900 HEADLAMP HOUSINGS PER HOUR

Six operations on each, a total of 5,400 press operations per hour. The part is formed from pre-blanked stock. Five 250 ton Transmats of this type are in service, the earliest since 1949.



19 1/2" x 3 3/4" x 5 1/2"—.1606" stock.

1000 AXLE HOUSINGS PER HOUR

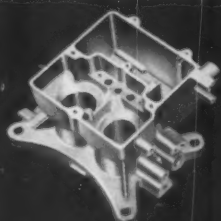
Seven operations on each, a total of 7,000 press operations per hour. The part is formed from previously developed blanks. Two such 2,200 ton Transmats have been in service for about one year.

PRESS COMPANY

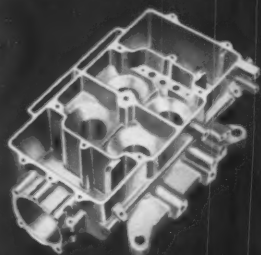
8300 S. Central Expressway, Dallas, Texas

PRESSES • DIE CUSHIONS • VERNON-WHEELON HYDRAULIC PRESSES



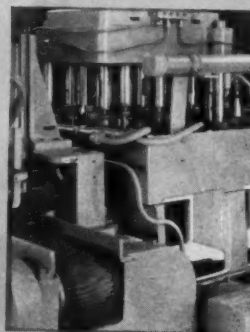
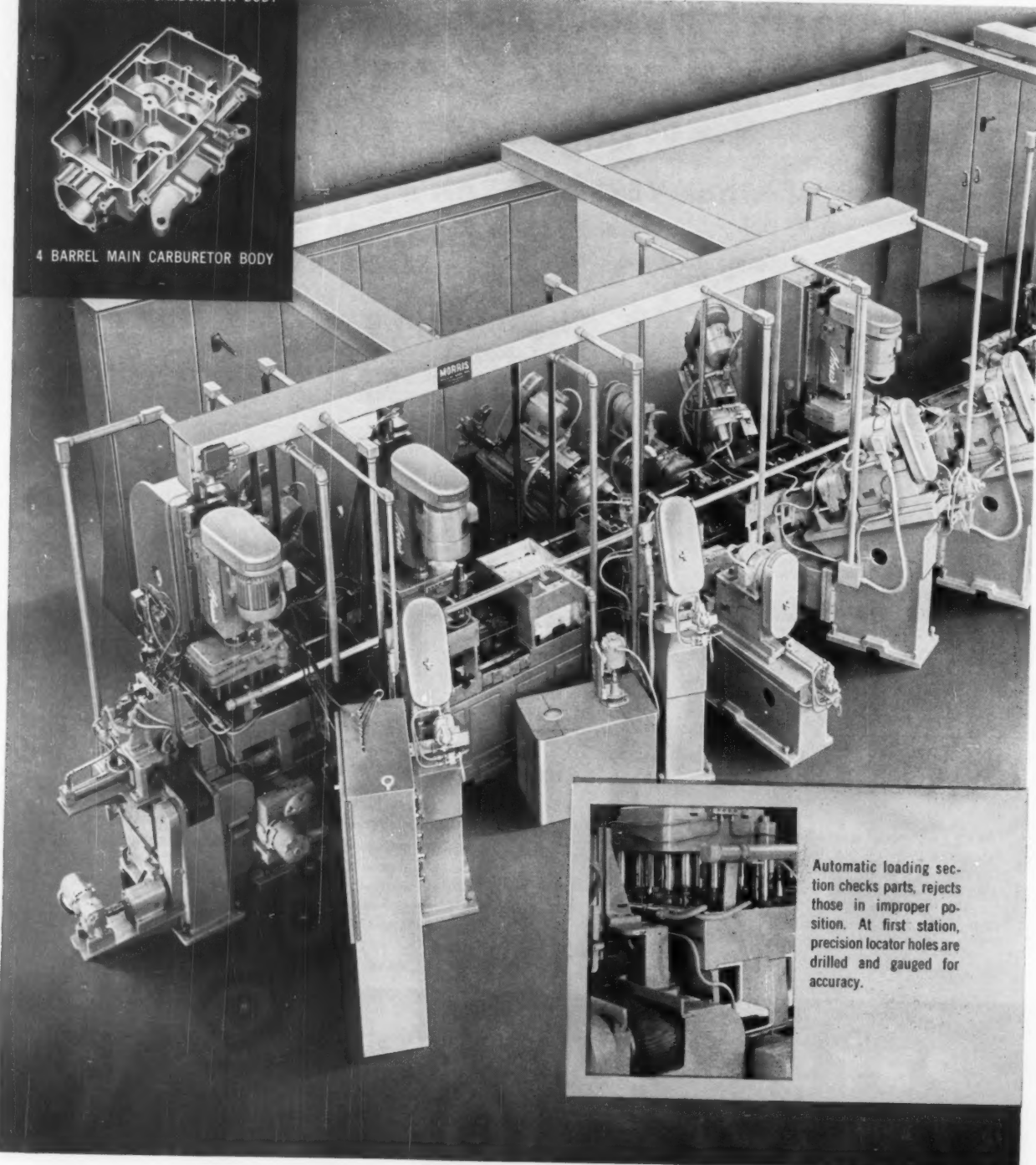


2 BARREL MAIN CARBURETOR BODY



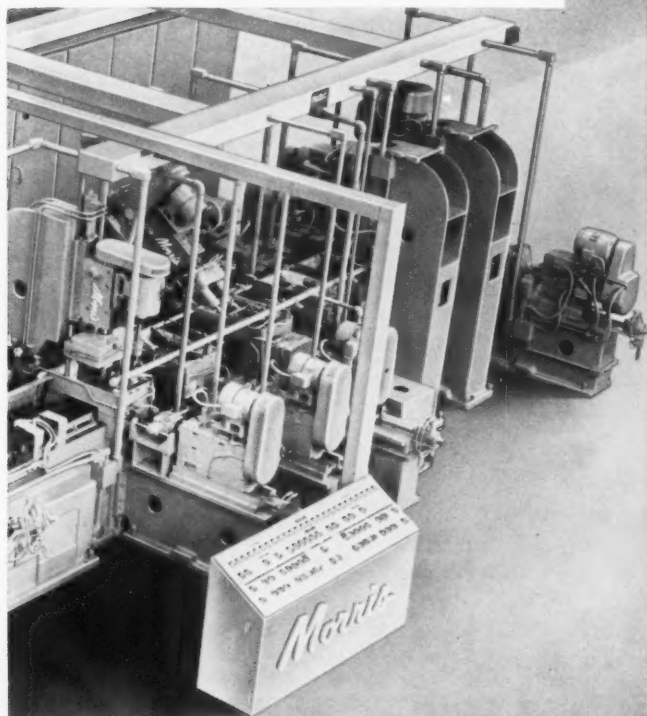
4 BARREL MAIN CARBURETOR BODY

one part completed every



Automatic loading section checks parts, rejects those in improper position. At first station, precision locator holes are drilled and gauged for accuracy.

7½ seconds!



new
Morris

**IN LINE TRANSFER TYPE
HIGH PRODUCTION
MACHINE**

**480 parts/hour
56 stations
90 operations**

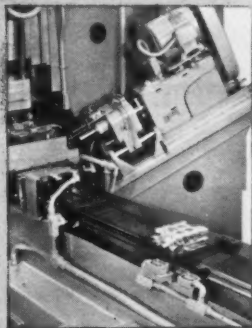
**31 DRILLING
19 BORING
10 REAMING
4 GAUGING
13 PROBING
13 TAPPING**

Fast . . . flexible . . . high speed production of 2- and 4-barrel carburetor bodies is completely automatic on this new MORRIS machine, designed for a major automotive manufacturer.

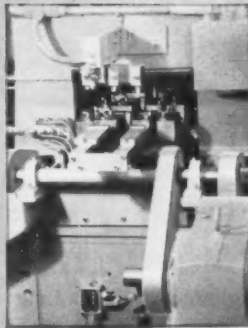
MORRIS designs, engineers and manufactures high production machines, using basic units and automatic drilling units . . . to provide a "special" machine at a fraction of the usual "special machine" price.

Write, outlining your production problem, or send samples of your parts for analysis by MORRIS engineers.

**THE MORRIS MACHINE TOOL CO.
946 HARRIET STREET
CINCINNATI 3, OHIO**



First and second sections may be operated individually or as a single unit. This center section provides automatic unloading and loading as required. Automatic storage may be provided.



Automatic delivery of parts to unloading conveyor (not shown) after machining. Note precision locating pins in fixtures.

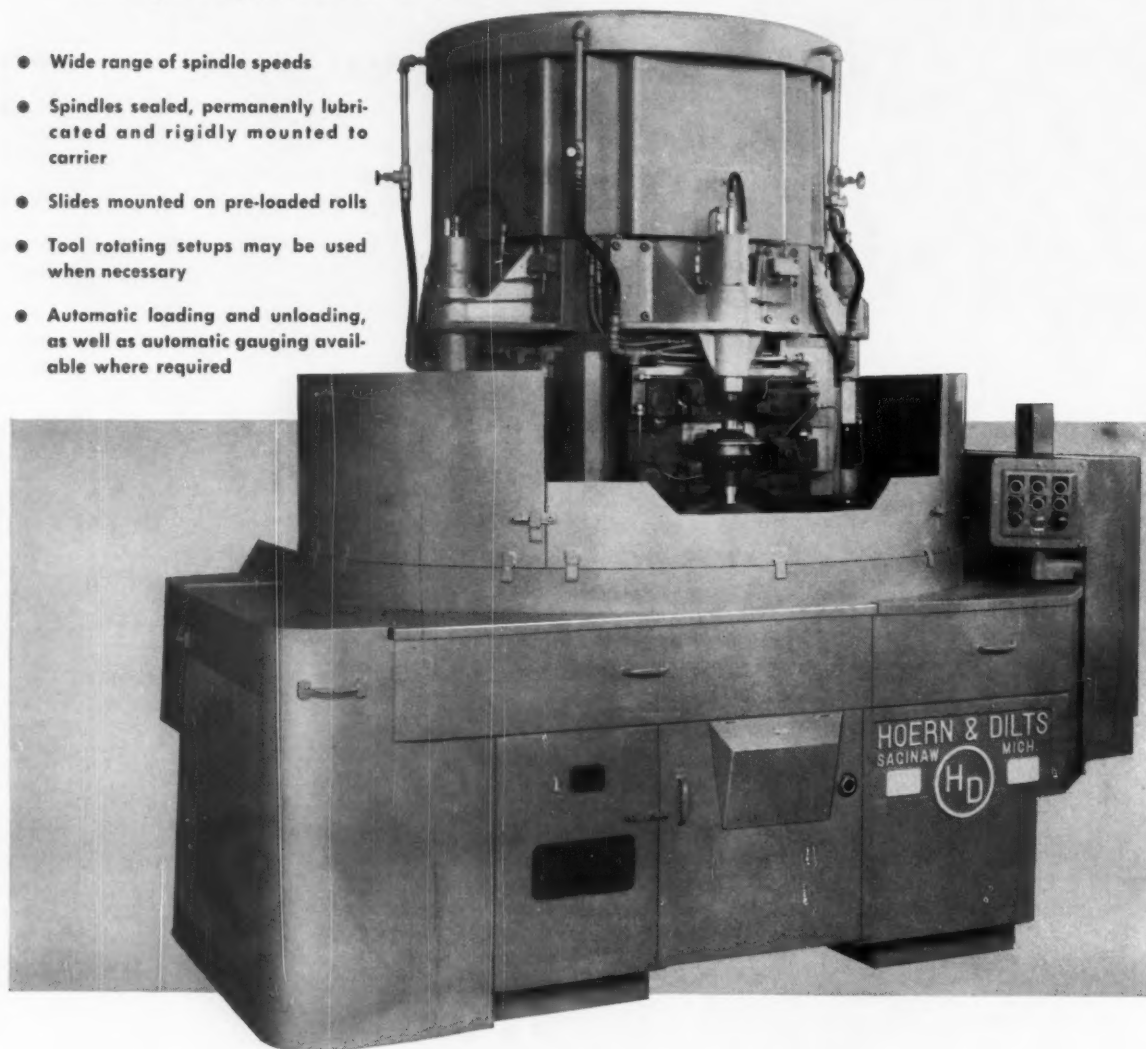
for your precision boring

5 times as many pieces every hour

Hoern & Dilts continuous boring machines have five sets of contour turning and boring slides, each serving one or two spindles and continuously moving around a central column. Slides and spindles travel together. Operator merely loads and unloads.

Pieces are completely turned, bored and faced in one circuit around the machine. One set of stationary cams actuating all slides provides absolute duplication of dimensions between stations.

- Wide range of spindle speeds
- Spindles sealed, permanently lubricated and rigidly mounted to carrier
- Slides mounted on pre-loaded rolls
- Tool rotating setups may be used when necessary
- Automatic loading and unloading, as well as automatic gauging available where required



Hoern & Dilts engineers will welcome the opportunity to cooperate with you on any high production finishing operation.

HOERN & DILTS DIVISION

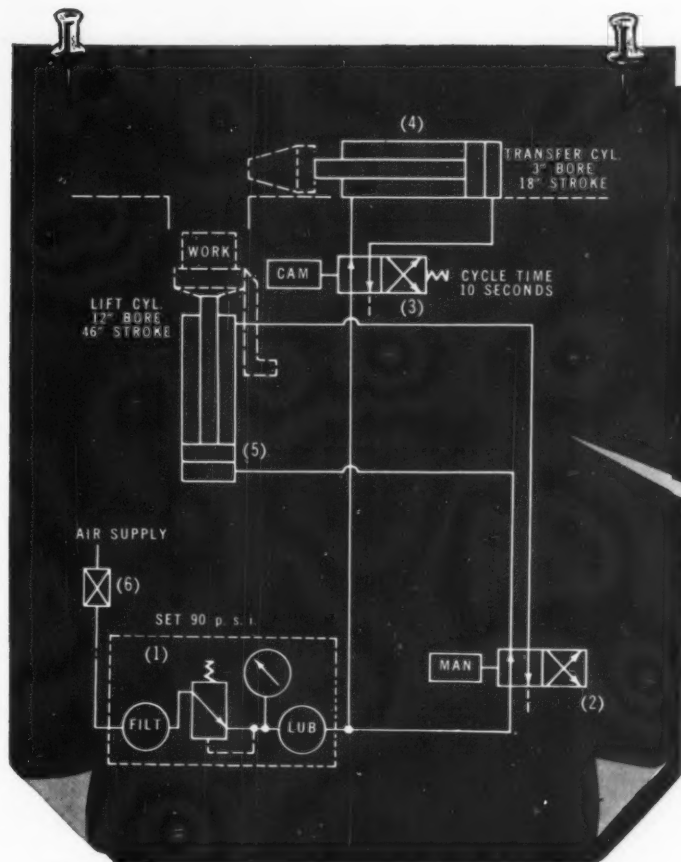
The New Britain Machine Company • Saginaw, Michigan

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Automatic Bar and Chucking Machines
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Cleveland, Ohio
Precision Horizontal Boring,
Drilling and Milling Machines



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AIR CIRCUITS



Write for FREE "Circuit Rider" booklet. It explains the above circuit plus many others.

how important is the RIGHT CIRCUIT?

One can't overestimate the importance of a properly designed and equipped circuit. Logan-designed circuits are operating all over the world. Let Logan engineers help you design the circuit to meet your production requirements. For a dependable ONE-SOURCE supplier of air and hydraulic equipment . . . specify Logan.



Your dependable **SINGLE SOURCE**
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810 CENTER AVENUE, LOGANSPOUT, INDIANA

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| <input type="checkbox"/> 100-1 AIR CYLINDERS | <input type="checkbox"/> 62 SURE-FLOW PUMPS |
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| <input type="checkbox"/> 100-4 AIR VALVES | <input type="checkbox"/> 200-3 750 SERIES HYD. CYLINDERS |
| <input type="checkbox"/> 100-5 LOGANSQUARE CYLINDERS | <input type="checkbox"/> 200-4 and 200-7 HYD. VALVES |
| <input type="checkbox"/> 100-5-1 ULTRAMATION CYLINDERS | <input type="checkbox"/> 200-6 SUPER-MATIC CYLS. |
| <input type="checkbox"/> 51 PRESSES | <input type="checkbox"/> 70-1 CHUCKS |
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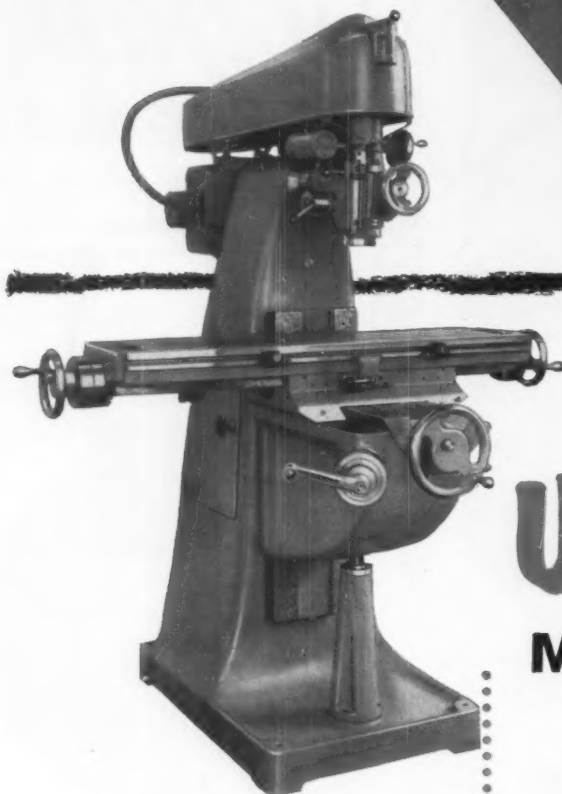
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NAME _____ TITLE _____

COMPANY _____

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Choice of hand or
power feed head and table



**BALANCED
RIGIDITY**

assures
***CERTIFIED
ACCURACY**

in the **NEW**

U.S. Vertical MILLING MACHINE



Tested 10 Ways!

The accuracy of each U. S. Vertical Milling Machine is certified. A check sheet accompanies every machine listing 10 exacting operational tests the machine has passed. The check shows allowable tolerances and actual measured tolerances of the individual unit. A new bulletin provides complete specifications and illustrates various accessories available on the new U. S. Vertical Milling Machine. Write for your **FREE** copy today.

Balanced rigidity, the key to accuracy for vertical and angular milling operations, is an integral part of the new U. S. Vertical Milling Machine.

These U. S. Vertical features provide rigidity for close tolerance work:

- Machine weighs 2000 pounds
- Extra wide bearing surfaces
- Motor mounted behind column, balances weight of head, resists vibration and deflection
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- Dovetails are deep and hand scraped
- Massive knee, saddle and table

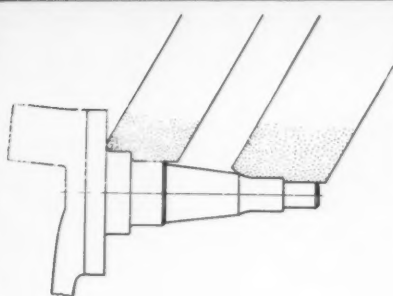
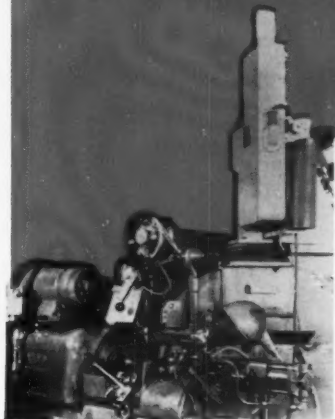
Drive by B section V belt

U * S * Burke
MACHINE TOOL DIVISION

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Cincinnati 27, Ohio**

Manufacturers of:
Burke Bench Mills, U. S. No. 1
Milling Machine and the radically
new U. S. Quarter

GRINDING WHEEL PROFILES never before possible



**ON
CYLINDRICAL
GRINDERS**

with the new

HOGGLUND

Model 86

CONTOUR WHEEL DRESSER

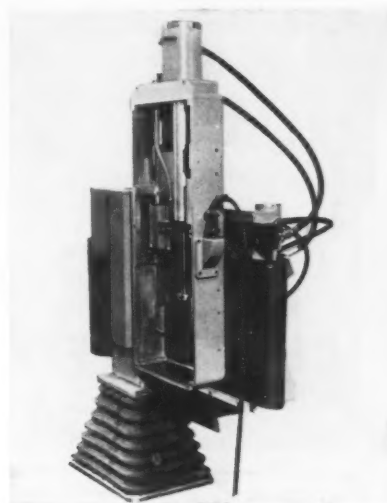
THE DRESSER WITH ENLARGED SYNCHRONIZED TEMPLATES

Now, with the Model 86, any complex contour can be formed on the grinding wheel, limited only by the size and shape of the Diamond. If the Diamond can enter into the profile, the profile can be dressed—in fact, any contour desired can be continuously and accurately dressed in one automatic cycle! Instead of single template bars, Model 86 uses a pair of enlarged synchronized templates to obtain the most complex contours. Model 86 insures absolutely **UNIFORM** peripheral contour movements—giving profiles heretofore considered impossible on Cylindrical grinders. Here is perfect contour grinding accuracy through correct dressing of abrasive wheels, the HOGGLUND way of practically eliminating skill in production contour grinding.



HOGGLUND

341 Snyder Ave., Berkeley Heights, N. J.
ENGINEERING & MANUFACTURING CO.



Check these features of HOGGLUND CONTOUR WHEEL DRESSERS

Precision

Automaticity

Will dress any angle on the grinding wheel, perpendicular as well as horizontal.

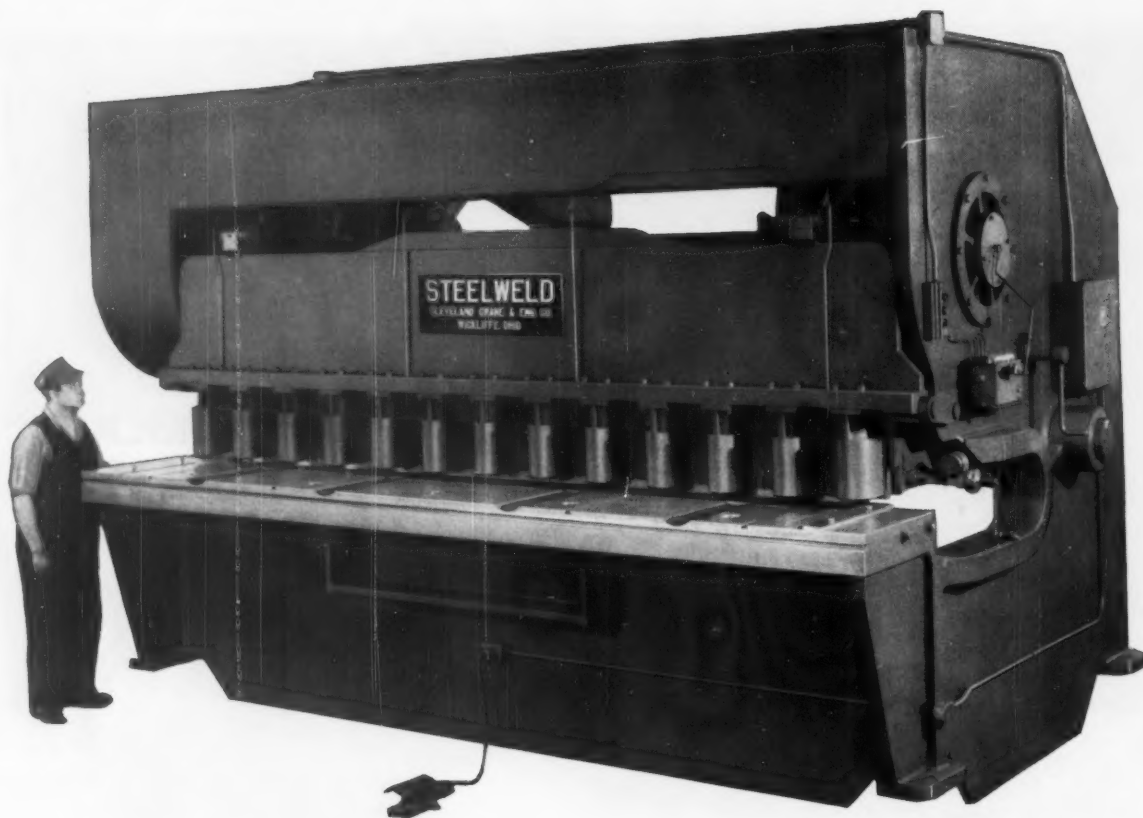
Not limited to shallow angles and profiles but will dress any angle up to perpendicular to the grinding spindle (can even undercut grinding wheels, if necessary).

Eliminates necessity of skill in contour grinding.

Set up time negligible. No skill required.

Diamonds optically set in Microscope. No adjustment required on machine when changing diamonds, so repetition within a tenth is possible.

Uniform peripheral dressing speed of diamond.



CUTS 12 FEET 3/4 INCH STEEL PLATE at 30 Strokes Per Minute

SOME FEATURES OF THIS SHEAR

1. Cuts by pivoted-blade principle.
2. Operated by electric foot switch.
3. Knife clearance adjusted by hand crank and dial indicator.
4. 36-inch throat permits slitting wide plate.
5. Lift-up type back gauge on ball bearings.
6. Heavy all-welded one-piece steel frame.

This is one of a complete line of Steelweld Pivoted-Blade Shears for cutting plate of all thicknesses from 1/4-inch to 1 1/2-inch and for lengths from 6 feet to 26 feet.

Steelweld Shears are radically different from all other shears now on the market. They have features never before possible. The revolutionary pivoted-blade travels in a circular path and overcomes handicaps of ordinary guillotine-type shears.

Not only are these machines easier to operate but their design assures smooth straight accurate cuts with minimum plate distortion. Their construction is extra heavy, and all modern features are incorporated to provide for ease of operation, minimum maintenance and long life.

Get the facts on these outstanding machines.



GET THIS BOOK!

CATALOG No. 2011 gives construction and engineering details. Profusely illustrated.

THE CLEVELAND CRANE & ENGINEERING CO.
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STEELWELD PIVOTED BLADE SHEARS



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ALL-PURPOSE
CUTTING BASE

COOLS OFF TOUGH MACHINING JOBS

RESULT: Faster Production That Really Pays Off

The cooling Power of ANTISEP A.P. Base gives you *more output per machine*. It enables you to increase both feed and speed.

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than eight cents per gallon in the machine.

Its tough film, anti-welding properties, and high lubricity produce better finishes with minimum rejects.

Decide now to increase the profits from your machining operations. Call the Houghton Man to arrange a convincing test . . . or write to E. F. Houghton & Co., 303 W. Lehigh Ave., Philadelphia 33, Pa.

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Ready to give you
on-the-job service . . .

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To find headings easily, look for capital letters at top of each page to denote location.

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Crane Packing Co., Morton Grove, Ill.

ABRASIVES, Discs

Besly-Welles Corp., 112 Dearborn Ave.,
Beloit, Wis.
Delta Power Tool Div., 400 N. Lexington Ave.,
Pittsburgh 8, Pa.
Gardner Machine Co., Beloit, Wis.
Norton Co., 1 New Bond St., Worcester, Mass.
Simonds Abrasive Co., Tacony and Fraley Sts.,
Bridgesburg, Philadelphia, Pa.

ABRASIVES, Polishing, Tumbling, Etc.

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Cratex Manufacturing Co., 81 Natoma St., San
Francisco, Calif.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Simonds Abrasive Co., Tacony and Fraley Sts.,
Bridgesburg, Philadelphia, Pa.

ACCUMULATORS, Hydraulic

Erie Foundry Co., 1253 W. 12th St., Erie, Pa.
Farrel-Birmingham Co., Inc., Ansonia, Conn.

AIR GAGES, Dimensional—See Gages Air Comparator

AIR GUNS

Chicago Pneumatic Tool Co., New York 17,
N. Y.
Schrader's Sons, A., 470 Vanderbilt Ave.,
Brooklyn 38, N. Y.

AIR TOOLS—See Grinders, Portable, Pneumatic Drills, Portable, Pneumatic, Etc.

ALLOY STEELS

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Carpenter Steel Co., Reading, Pa.
Columbia Tool Steel Co., Chicago Hts., Ill.
Crucible Steel Co. of America, Oliver Bldg.,
Pittsburgh 30, Pa.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh
30, Pa.
Ryerson, Joseph T., & Son, Inc., 2558 W. 16th
St., Chicago 18, Ill.
U. S. Steel Corp., Carnegie-Illinois Steel Corp.
Div., 436 7th Ave., Pittsburgh, Pa.
Vanadium Alloys Steel Co., Latrobe, Pa.
Wheelock, Lovejoy & Co., Inc., Cambridge,
Mass.

ALLOYS, Bearing

Bunting Brass & Bronze Co., 715 Spencer,
Toledo 1, Ohio.
Carpenter Steel Co., 105 W. Bern St., Reading,
Pa.
Crucible Steel Co. of America, Henry W. Oliver
Bldg., Mellon Square, Pittsburgh 22, Pa.
Mueller Brass Co., Port Huron, Mich.

ALLOYS, Non-ferrous—See Brass, Cop- per, Zinc and Stellite

ALUMINUM and Aluminum Products

Bridgeport Brass Co., Bridgeport, Conn.
Mueller Brass Co., Port Huron, Mich.
Revere Copper & Brass, Inc., 230 Park Ave.,
New York 17, N. Y.
Ryerson & Son, Jos. T., 16th & Rockwell Sts.,
Chicago 8, Ill.

ANGLE PLATES—See Set-Up Equipment

ANNEALING FURNACES

Ajax Electric Co., Frankford at Delaware,
Philadelphia 23, Pa.
Eisler Engrg. Co., 750 So. 13th St., Newark 3,
N. J.
General Electric Co., Schenectady, N. Y.

ARBOR PRESSES—See Presses Arbor

ARBORS AND MANDRELS

Brown & Sharpe Mfg. Co., Providence, R. I.
Chicago-Latrobe Twist Drill Works, 411 W.
Ontario St., Chicago, Ill.
Cleveland Twist Drill Co., 1242 E. 49th St.,
Cleveland, Ohio.
Jacobs Mfg. Co., West Hartford, Conn.
Kearney & Trecker Corp., Milwaukee 14, Wis.
Logansport Mch. Co., Inc., Logansport, Ind.
South Bend Lathe Wks., South Bend 22, Ind.
Supreme Products, Inc., 2222 So. Calumet Ave.,
Chicago 16, Ill.
Wesson Co., 1220 Woodward Heights Blvd.,
Ferndale, Mich.
Whitman & Barnes, 40600 Plymouth Rd.,
Plymouth, Mich.

(Continued on page 308)

WHEN SHARPENING DRILLS

PRECISION

IS ALL-IMPORTANT...

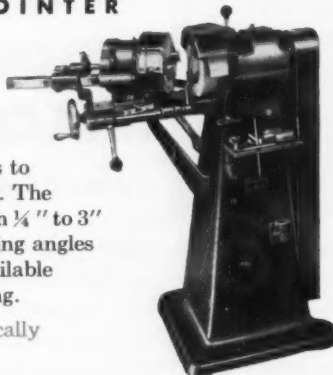
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Oliver
DRILL POINTER

With the Oliver 510 Drill Pointer, all of the move-
ments in sharpening a drill
are automatic, and accom-
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eliminate all chance of error. The
Oliver 510 holds all drills from $\frac{1}{4}$ " to 3"
diameter and provides varying angles
from 82 to 160 degrees. Available
for either wet or dry grinding.

Oliver achieves the theoretically
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SEND A FEW DRILLS FOR FREE RESHARPENING . . . THEN BUY!



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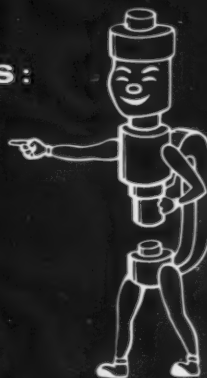
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FACE MILL GRINDERS • AUTOMATIC DRILL GRINDERS • DIE MAKING MACHINES
TOOL & CUTTER GRINDERS • DRILL POINT THINNERS • TEMPLATE TOOL GRINDERS

1
COOLANT
THRU THE
WHEEL...

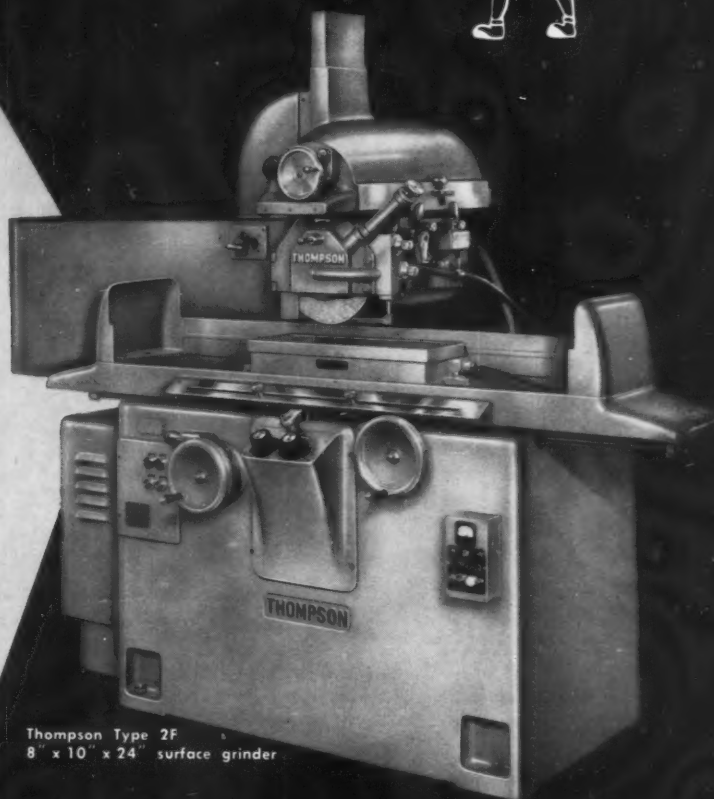
PRECISION PETE SAYS:

Only Thompson
Type 2F Grinder
has all three
available...



2
... COOLANT
EXTERNALLY ON
THE WORK...

3
... AND
"IN POSITION"
WHEEL
TRUING



Thompson Type 2F
8" x 10" x 24" surface grinder

MANUFACTURERS
OF THE WORLD'S
MOST COMPLETE LINE
OF SURFACE GRINDERS

WRITE TODAY FOR DESCRIPTIVE DATA

THE THOMPSON GRINDER COMPANY
SPRINGFIELD, OHIO

Thompson
SURFACE
Grinders

"The Sky's The Limit" when it comes to profitable uses for **MAGNA-LOCK CHUCKS**



Your investment in a Magna-Lock electro-magnetic chuck is an investment in *versatility* which pays real dividends many times over. In addition to normal surface grinding operations, users are constantly finding new and practical applications of the *extra holding power* of Magna-Lock Chucks for jobs such as these:

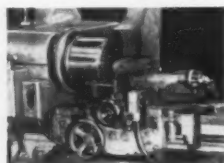


MILLING OPERATION

66% reduction in setup time for milling cast iron gibs at Turchan Follower Machine Co.

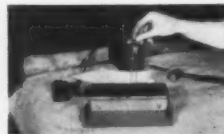


FLAME HARDENING



LATHE OPERATION

Holding $\frac{1}{4}$ " thick steel discs for grooving. Production, 300 pieces per hour. Wabash Div., Raybestos Manhattan Co.



LAYOUT WORK



TRANSFERRING PARTS

loading and unloading water heater shells at Permglas Div., A. O. Smith Corp.



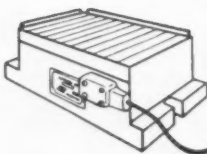
HAND FILING

Your jobs, too, can be done faster, at less cost through the 22% *extra holding power* of Magna-Lock Chucks—all steel, moisture-proof, shock-proof. Rectangular chucks from 5" x 10" to 30" x 96" working surfaces—rotary chucks from 6 $\frac{1}{4}$ " diameter face to 72" diameter—swiveling chucks from 5" x 10" to 12" x 84".

To get the most for your money, specify Magna-Lock. To make the most of Magna-Lock versatility, consult our engineers about your idea or problem. We'll be happy to work with you.

WRITE DEPT. M-116

Request Magna-Lock as *original* equipment on your new machines.



Hanchett MAGNA-LOCK CORPORATION

BIG RAPIDS, MICHIGAN, U. S. A.

designers and makers of a complete line of magnetic chucks and devices.

ARC WELDERS—See Welding Equipment, Arc

AUTOMATIC SCREW MACHINES—See Screw Machines, Single- and Multiple-Spindle Automatic

BABBITT

American Crucible Products Co., Lorain, Ohio.
Ryerson, Jos. T., & Son, 2558 W. 16th St., Chicago 18, Ill.

BALANCING EQUIPMENT

Gisholt Machine Co. (Static and Dynamic), 1245 E. Washington Ave., Madison 10, Wis.
LaSalle Tool, Inc., 3840 E. Outer Dr., Detroit 34, Mich.
Sundstrand Mach. Tool Co., 2531 11th St., Rockford, Ill.

BALL-MAKING MACHINES

Haynes Stellite Co., Kokomo, Ind.
New Departure Div., Bristol, Conn.

BAR MACHINES—See Screw Machines, Single- and Multiple-Spindle, Automatic

BAR STOCK, Non-ferrous

American Crucible Prod. Co., Port Huron, Mich.
Bunting Brass & Bronze Co., 715 Spencer, Toledo, Ohio.
Centrifugally Cast Products Div., Shenango Furnace Co., Dover, Ohio.
Mueller Brass Co., Port Huron, Mich.
Ryerson, Jos. T., & Son, 2558 W. 16th St., Chicago 18, Ill.

BAR STOCK AND SHAFTING, Steel

Bethlehem Steel Co., 701 East Third St., Bethlehem, Pa.
Boston Gear Works, 14 Hayward St., Quincy 71, Mass.
Carpenter Steel Co., 105 W. Bern St., Reading, Pa.
Crucible Steel Co. of America, Henry W. Oliver Bldg., Mellon Sq., Pittsburgh 22, Pa.
Cumberland Steel Co., Cumberland, Md.
Ryerson, Jos. T., & Son, 2558 W. 16th St., Chicago 18, Ill.

BARs, Steel

Allegheny Ludlum Steel Corp., Bethlehem, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Carpenter Steel Co., Reading, Pa.
Columbia Tool Steel Co., Chicago Hts., Ill.
Crucible Steel Co. of America, Oliver Bldg., Pittsburgh 30, Pa.
Ryerson, Joseph T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Timken Roller Bearing Co., Canton, Ohio.
U. S. Steel Corp. (American Steel & Wire Co. Div., Carnegie-Illinois Steel Corp. Div., Columbia Steel Co. Div., Tennessee Coal, Iron & R. R. Co. Div.), 436 7th Ave., Pittsburgh, Pa.
Wheelock, Lovejoy & Co., Inc., Cambridge, Mass.

BEARING PILLOW BLOCKS AND CARTRIDGES

Fafnir Bearing Co., New Britain, Conn.

BEARINGS, Ball

Ball & Roller Bearing Co., Danbury, Conn.
Boston Gear Works, 3200 Main St., North Quincy, Mass.
Fafnir Bearing Co., New Britain, Conn.
Federal Bearings Co., Inc., Poughkeepsie, New York
Marlin-Rockwell Corp., 402 Chandler Bldg., Jamestown, N. Y.
New Departure Div., Bristol, Conn.
Nice Ball Bearing Co., 30th & Hunting Park Ave., Philadelphia, Pa.
Norma-Hoffman Bearings Corp., Stamford, Conn.

(Continued on page 310)

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first in quality
first in acceptance
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DIE STEELS

for **cold work**

Colonial No. 6

The most versatile of all cold work die steels. A manganese oil hardening type specially annealed for easy machining—the best steel for general tool room work. Available from stock in all warehouses.

Air Hard

A deep hardening steel having exceptional strength and toughness. Hardens to Rockwell "C" 65 by cooling in still air with considerably less movement than manganese steels. A general-purpose die steel with exceptional resistance to wear. Also available in FM (free machining) type. Stocked in all warehouses.

Ohio Die

Air (or oil) hardening, high carbon-high chromium steel providing least movement in hardening, maximum wear life, and strength and toughness sufficient for virtually every cold work die steel application. Wear resistance five to eight times that of low alloy steels. Available in FM (free machining) type also. Stocked in all warehouses.

FIRST QUALITY Die Steels, known and used by discriminating diemakers throughout America wherever better behavior in fabrication and longer life in service lead the list of specifications. Each of these famous steels offers special advantages in service, joining with the other grades in our Cold Work die steels family to blanket every application requirement. Available in precision-ground flats and squares. Let us send you detailed Data Sheets for your files.

Vanadium-Alloys Steel Company

Latrobe, Pennsylvania

SUBSIDIARIES: Colonial Steel Co. • Anchor Drawn Steel Co. • Pittsburgh Tool Steel Wire Co. • Vanadium-Alloys Steel Canada Limited
Vanadium-Alloys Steel Societa Italiana Per Azioni



SUPREME Push-Pull Tapper

**New Power Drill Attachment
Taps to Highest Standards . . .
Cuts Breakage . . . Lowers Costs**

Mill & Factory Magazine's Board of Review has designated Supreme's new Push-Pull Tapper as winner of their "Feature Product Award" for October. This Board is composed of a group of engineers, editors and production experts who each month study hundreds of new items that are being offered to industry for the first time. They select the one product they feel is the most needed by all industry.

The Supreme PUSH-PULL TAPPER is an instant-reversing speed reduction unit made expressly for tapping. It attaches easily to either the spindle or chuck of any portable drill. Detachment after use is equally simple. The speed reduction of 7:1 gives more than adequate power to tap in all materials, and the instant-reversing means that the direction of the tap can be reversed without stopping the drill motor. Thus the tap can be moved into and out of the hole at will.

Reduces Tap Breakage

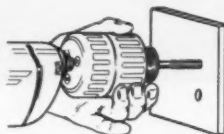
Tap breakage is held to minimum when the PUSH-PULL TAPPER is used, because the operator has a better "feel" for his work. When in use the TAPPER housing is held in the finger-tips, and any unusual strain is felt immediately. Releasing the fingers stops the tap instantly.

Handles Taps Up to 5/16" Dia.

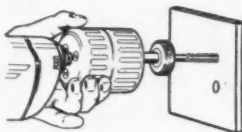
The complete PUSH-PULL TAPPER Kit, No. 9000, costs just \$29.95; includes everything except taps. Order from your Industrial Distributor.

SUPREME PRODUCTS CORPORATION
2222 SOUTH CALUMET AVENUE, CHICAGO 16, ILLINOIS

HOW IT WORKS:



Push and the tap runs in smoothly . . .



Pull and it comes out easily . . .

That's all you do—**Push-Pull**

By the makers of
famous **SUPREME**
brand **CHUCKS**

On new equipment
... for every re-
placement... de-
mand Supreme
Chucks... the line
that's "UP FRONT"
on leading power
tools. Exclusive
hardening process
assures finer service.



BEARINGS, Bronze and Special Alloy
American Crucible Products Co., 1395 Oberlin Ave., Lorain, Ohio
Boston Gear Works, 3200 Main St., North Quincy, Mass.
Bunting Brass & Bronze Co., Spencer and Carlton Aves., Toledo, Ohio.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York, N. Y.
Shenango-Penn Mold Co., Dover, Ohio.

BEARINGS, Needle

Orange Roller Bearing Co., Inc., Orange, N. J.

BEARINGS, Oilless

American Crucible Prod. Co., Lorain, Ohio.
Bunting Brass & Bronze Co., 715 Spencer, Toledo 1, Ohio.
Ryerson, Jos. T., & Son, 7558 W. 16th St., Chicago 18, Ill.

BEARINGS, Roller

Ball & Roller Bearing Co., Danbury, Conn.
Marlin-Rockwell Corp., 402 Chandler Bldg., Jamestown, N. Y.
Norma-Hoffman Bearings Corp., Stamford, Conn.
Orange Roller Bearing Co., Inc., Orange, N. J.
Rollway Bearings Co., Inc., 541 Seymour St., Syracuse, N. Y.
Timken Roller Bearing Co., Canton, Ohio.

BEARINGS, Thrust

Ball & Roller Bearing Co., Danbury, Conn.
Bunting Brass & Bronze Co., Spencer and Carlton Aves., Toledo, Ohio.
Fafnir Bearing Co., New Britain, Conn.
General Electric Co., Schenectady, N. Y.
Marlin-Rockwell Corp., 402 Chandler Bldg., Jamestown, N. Y.
Nice Ball Bearing Co., Nicetown, Philadelphia, Pa.
Norma-Hoffman Bearings Corp., Stamford, Conn.
Orange Roller Bearing Co., Inc., Orange, N. J.
Rollway Bearing Co., Inc., Syracuse, N. Y.
Shenango-Penn Mold Co., Dover, Ohio.
Timken Roller Bearing Co., Canton, Ohio.

BELT SANDERS—See Grinding Machines, Abrasive Belt

BELTING, Transmission

Houghton, E. F. & Co., 303 W. Lehigh Ave., Philadelphia, Pa.

BENCH CENTERS

Brown & Sharpe Mfg. Co., Providence, R. I.
Delta Power Tool Div., 400 N. Lexington Ave., Pittsburgh 8, Pa.
Sundstrand Mch. Tool Co., 2531—11th St., Rockford, Ill.

BENCHES AND STOOLS

South Bend Lathe Works, South Bend 22, Ind.

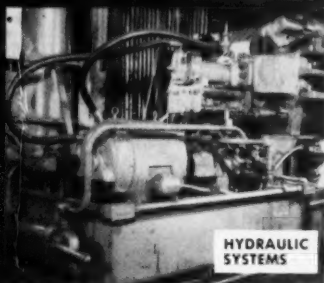
BENDERS, Bar, Tube, Channel, etc.

Bath, Cyril Co., 32324 Aurora Road, Solon, Ohio.
Greenless Bros. & Co., 2136—12th St., Rockford, Ill.

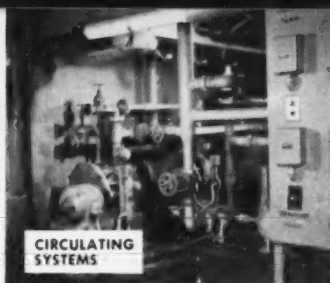
BENDERS, Plate, Etc.

Bath, Cyril Co., 32324 Aurora Road, Solon, Ohio.
Cincinnati Shaper Co., Hopple & Gerrard, Cincinnati, Ohio.
Niagara Mch. & Tool Wks., 637 Northland Ave., Buffalo 11, N. Y.

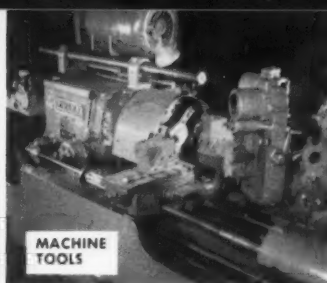
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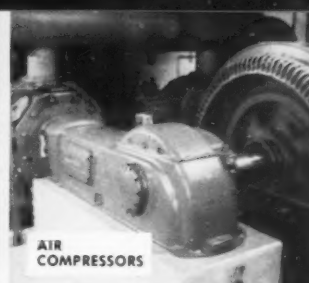
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SYSTEMS



CIRCULATING
SYSTEMS



MACHINE
TOOLS



AIR
COMPRESSORS

GENERAL LUBRICATION



SUN SOLNUS OILS IDEAL LUBRICANTS FOR 80% OF ALL APPLICATIONS

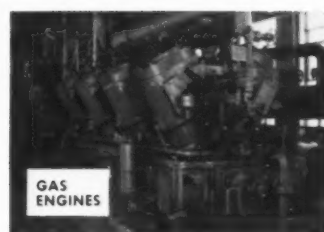
Moderately priced...low in carbon-forming tendencies, Sun Solnus® oils simplify your storage problems by doing with *one oil* many jobs that would otherwise require *several*. Their ability to protect metal parts against corrosion, their resistance to oxidation, and their moderate price all add up to "more lubrication per dollar."

For technical information, see your Sun representative, or write to SUN OIL COMPANY, Philadelphia 3, Pa., Dept. I-51.

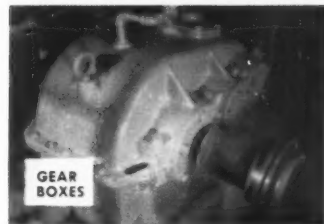


INDUSTRIAL PRODUCTS DEPARTMENT
SUN OIL COMPANY
PHILADELPHIA 3, PA. © SUN OIL CO.

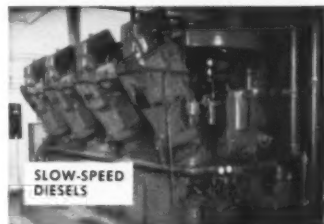
In Canada: SUN OIL COMPANY LIMITED, Toronto and Montreal



GAS
ENGINES



GEAR
BOXES



SLOW-SPEED
DIESELS



Valve on left is from compressor run for 3,000 hours with well-known, high-grade oil. At right is same valve after a 3,000-hour run with Sun Solnus oil. Note difference in carbon deposits.

3000-HOUR TEST PROVES SUN SOLNUS OILS REDUCE CARBON BUILD-UP IN COMPRESSORS

Equipment: A three-stage Norwalk horizontal-type compressor. Operating pressure: from 1,000 to 1,500 psi.

Test: The compressor was cleaned thoroughly and filled with a well-known, high-grade oil. The equipment was run for 3,000 hours, then torn down for inspection and cleaning. Then Solnus® 300 was tested in the same way.

Results: Look at the two pictures. You can see for yourself how Solnus oil reduced dangerous carbon build-up.

All types of reciprocating air compressors that have been changed over to a Sun Solnus oil show similar results. A test in your compressor will show the same remarkable reduction of carbon deposits.

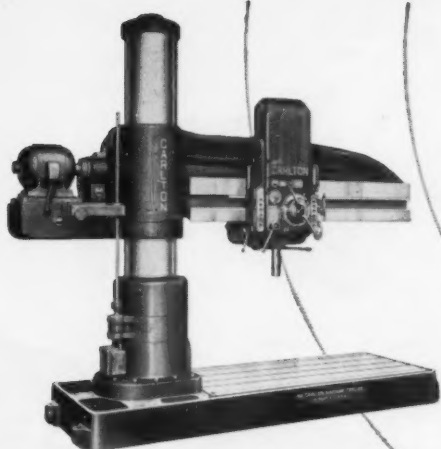
You can get a technical bulletin about Sun Solnus oils by asking your Sun representative, or write to SUN OIL COMPANY, Philadelphia 3, Pa., Dept. I-52.



INDUSTRIAL PRODUCTS DEPARTMENT
SUN OIL COMPANY PHILADELPHIA 3, PA.

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radial drills

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a choice
of **3**
speed-feed
controls...

Programming for pre-selecting speeds and feeds for an entire drilling program including as many as 20 or 30 operations. *Pre-selector* for setting speed and feed for the next operation while machine is still under cut. *Manual* to take advantage of Carlton's centralized push button control. For further information, send today for free descriptive bulletin. The Carlton Machine Tool Co., Cincinnati 25, Ohio.



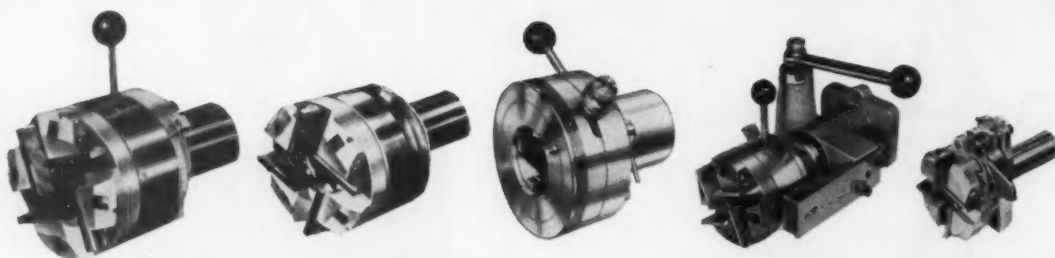
programming



pre-selector

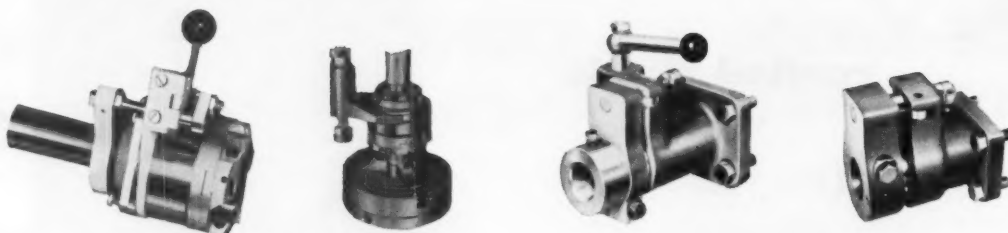


manual

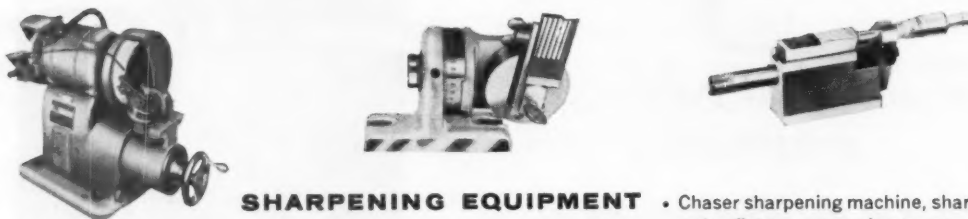


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Jones & Lamson's thread



ACCESSORIES • External and internal trip attachments, drill press adapters, floating holders.



SHARPENING EQUIPMENT • Chaser sharpening machine, sharpening fixture, measuring gages.

Class III threads guaranteed . . . every time!

JONES & LAMSON

JONES & LAMSON MACHINE COMPANY, 512 CLINTON ST., SPRINGFIELD, VT. U. S. A.

Jones & Lamson recently purchased the Modern Tool Works, Rochester, N. Y. This acquisition greatly broadens J&L's service in the thread tool field, by integrating the products and designs of both companies.

Now, J&L, operators of the world's most modern thread tool plant, offers you its own complete lines of die heads and chasers, accessories and sharpening equipment, plus a line of collapsible taps and chasers, solid adjustable taps and chasers, the Modern-Magic Chuck, and the Modern Stud Setter. Complete engineering service is also offered for the entire new combined line of products.

Send today for complete literature.

tool line now includes...

**J&L MC
COLLAPSIBLE TAPS**

The same tap may be used on either stationary or rotating jobs. One complete tap, plus parts, gives you five sizes of taps ranging from $1\frac{1}{16}$ " to $3\frac{1}{2}$ ".

**J&L MS SOLID
ADJUSTABLE TAPS**

With ground-thread, precision chasers. Chasers can be removed from tap, reground and reset to cut to original size.

**MODERN-
MAGIC CHUCKS...**

Positive or adjustable friction drive for horizontal or vertical use. MODERN-MAGIC Quick Change Chucks and Collet Equipment virtually eliminate costly idle time of revolving spindles. Using these chucks, tools can be changed without stopping or even slowing the spindle. They give multiple spindle range to single-spindle machines. For instance: you can change collets as fast as you can index a turret.

**AND COLLET
EQUIPMENT**

**J&L STUD
SETTERS**

The new Style M Self-Opening Stud Setter's four-ball drive clutch gives more positive disengagement for more accurate stud heights.

MACHINE COMPANY

THREAD TOOL DIVISION

AMES

*Long Range
Dial
Indicators*

Check Motions or Dimensions
In .001" up to 10" Range.

Ames Long Range Dial Indicators in a variety of models are made for quality control applications requiring close tolerance and inspection. For example, you can measure in .001", long slide travel, large cams, deep recesses or other dimensions requiring indicator spindle travel of up to 10".

In addition, Ames Long Range models have all the advantages that are built into Ames regular indicators:—dials of large diameter; easy-to-read, widely spaced graduations; movable dials; replaceable contacts. All Ames Long Range indicators have count hands to indicate revolutions of the indicator hand. Those with box covered, rack guide have a slot in the cover graduated to register each inch of spindle movement.

Write today, sending your problem in long range measuring. Ames will be glad to suggest a solution. Be sure to include drawings and specifications—your answer will be back faster if you do.

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MANUFACTURER OF MICROMETER DIAL GAUGES • MICROMETER DIAL INDICATORS

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Farquhar, A. B., Div. Oliver Corp., York, Pa.
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Lake Erie Engrg. Corp., Kenmore Sta., Buffalo, N. Y.
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Ottumiller, W. H., & Co., York, Pa.
Parker-Kalon Div., Clifton, N. J.
Russell, Burdall & Ward Bolt & Nut Co., Port Chester, N. Y.
Standard Pressed Steel Co., Jenkintown, Pa.
Williams & Co., J. H., 400 Vulcan St., Buffalo 7, N. Y.

BOOKS, Technical

Industrial Press, 93 Worth St., New York 13, N. Y.

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Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
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Davis Boring Tool Div., Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Delta Power Tool Div., 400 N. Lexington Ave., Pittsburgh 8, Pa.
Ingersoll Milling Machine Co., 2442 Douglas St., Rockford, Ill.
McCroskey Tool Corp., Meadville, Pa.
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Universal Engineering Co., Frankenmuth 2, Mich.
Van Norman Mch. Co., 3640 Main St., Springfield 7, Mass.
Warner & Swasey, 5701 Carnegie Ave., Cleveland 3, Ohio.
Wesson Co., 1220 Woodward Heights Blvd., Detroit 20, Mich.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

(Continued on page 318)

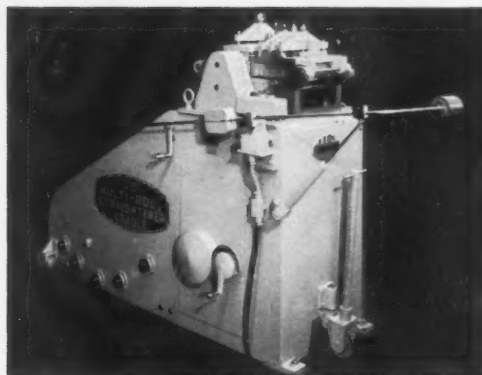
When steel is
3 times stronger
than iron . . .

Has two and
one-half times
the rigidity . . .

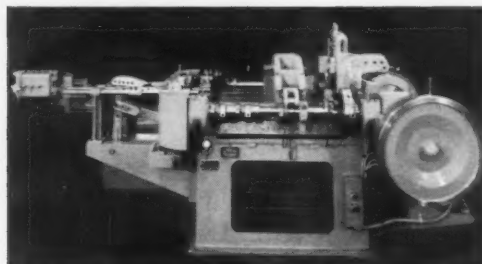
Yet costs
a third as much
per pound . . .

WHY
aren't more of
your products
designed for
welded steel?

*Photos courtesy
U. S. Tool Company, Inc.,
Amper, New Jersey.*



Present welded steel design.



Present welded steel design.

Cuts high replacement costs... after switching to welded bases

AFTER casting failures resulted in expensive replacement costs, this machine tool manufacturer converted his base designs to welded steel. Bases are now practically breakproof. Greater uniformity in dimensions saves time in locating parts in jigs. Appearance is greatly improved.

Lincoln can show you how to convert your designs to welded steel for similar savings and benefits. Write us today.

THE LINCOLN ELECTRIC COMPANY

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*Creating lower costs for industry
... with welded steel*



send it out to **CDT**

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Columbus Die-Tool
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UNITS FOR MACHINE TOOLS • also Builders of Machine Tools Complete*

316—MACHINERY, November, 1956

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M & M Giant Keyseaters cut internal keyways or splines in the bores of pulleys, gears, flywheels and other machine parts. Fast, accurate operation. Built in a wide range of sizes. Special fixtures and cutters available for unusual shapes and taper work. Write today for complete information.

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HEAVY METAL • CERMETS • HIGH TEMPERATURE ALLOYS
OVER 25 YEARS' EXPERIENCE IN TUNGSTEN CARBIDE METALLURGY

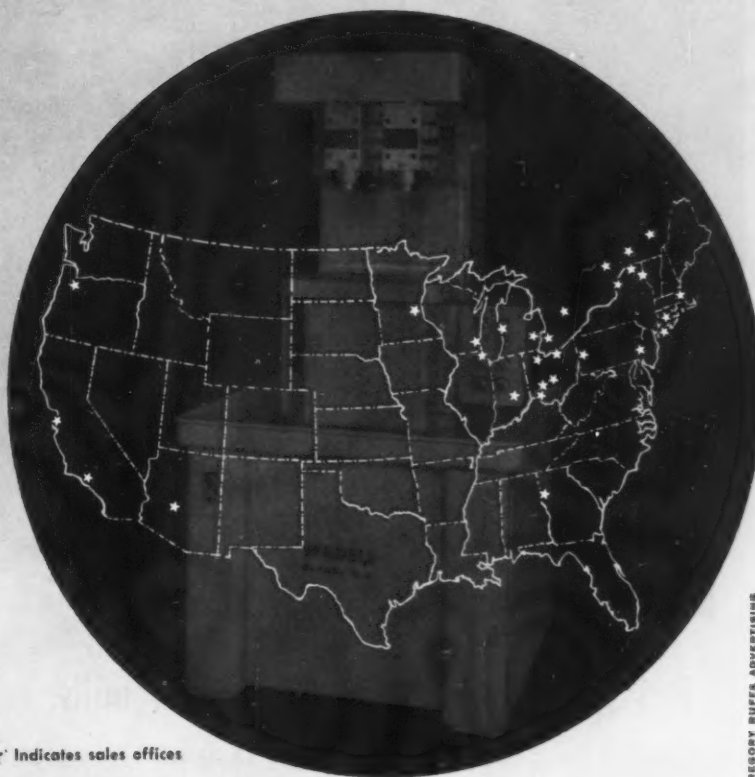
WADELL FEATURES

dealers across the nation

Wadell Vertical Precision Boring Machines, Automatic Indexing Tables, High Precision Spindles and Complete Tooling Services are available nationwide through these exclusive dealers.

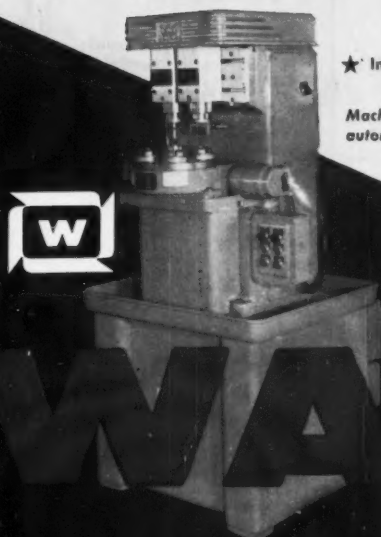
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In any case, we urge you to investigate the many advantages the compact VBM can offer you at reasonable cost.



★ Indicates sales offices

Machine illustrated with automatic indexing table completely tooling.

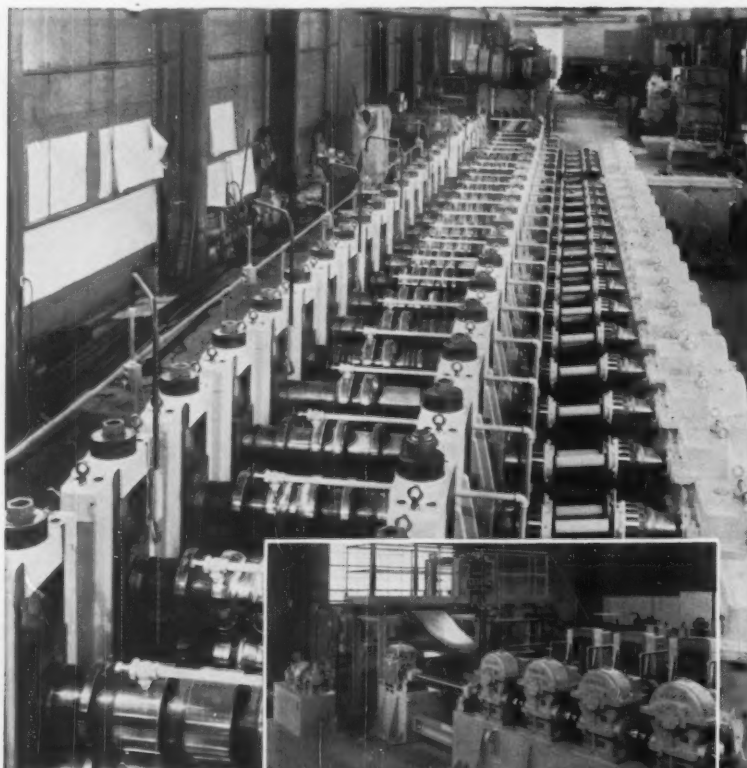


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Years of experience prove that *rugged construction* and *ample overload capacity* of H & S products assure trouble-free service and operating economy. If you have a power transmission problem, we'll be glad to help you. With our complete lines to choose from, you're assured of our unbiased recommendation. Contact your H & S representative, or write us today.

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Cleveland 14, Ohio

Send note on Company Letterhead for complete H & S Catalog

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Bryant Chucking Grinder Co., Clinton St., Springfield, Vt.
Davis Boring Tool Div., Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Heald Machine Co., 10 New Bond St., Worcester 6, Mass.
Homstrand, Inc., Larchmont, N. Y.
Michigan Drill Head Co., Van Dyke, Mich.
Millholland, W. K. Machinery Co., 6402 Westfield Blvd., Indianapolis 5, Ind.
Mummert-Dixon Co., Hanover, Pa.
Standard Electrical Tool Co., 2500 River Rd., Cincinnati 4, Ohio.
Universal Engineering Co., Frankenmuth 2, Mich.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.

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Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio.
Bullard Co., Bridgeport 6, Conn.
Consolidated Mch. Tool Div., 565 Blossom Rd., Rochester 10, N. Y.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Cross Co., 3250 Bellevue, Detroit 7, Mich.
Davis & Thompson Co., 4460 N. 24th St., Milwaukee 10, Wis.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Giddings & Lewis Mch. Tool Co., Fond du Lac, Wis.
Gray Co., G. A., 3611 Woodburn Ave., Cincinnati 7, Ohio.
Heald Machine Co., 10 New Bond St., Worcester 6, Mass.
Homstrand, Inc., Larchmont, N. Y.
Kearney & Trecker Corp., Milwaukee, Wis.
LaSalle Tool, Inc., 3840 E. Outer Dr., Detroit 34, Mich.
Michigan Drill Head Co., Van Dyke, Mich.
Millholland, W. K. Machinery Co., 6402 Westfield Blvd., Indianapolis 5, Ind.
Moline Tool Co., Moline, Ill.
National Automatic Tool Co., Inc., S. 7th and N. Sts., Richmond, Ind.
New Britain Mch. Co., New Britain-Gridley Mch. Div., New Britain, Conn.
Olofsson Corp., Lansing, Mich.
Pope Machinery Co., Haverhill, Mass.
Sheffield Corp., Box 893, Dayton 1, Ohio.
Snyder Tool & Engrg. Co., 3400 E. Lafayette St., Detroit 9, Mich.
Wadell Equipment Co., Clark, N. J.
Wales-Strippit Co., No. Tonawanda, N. Y.

BORING MILLS, Horizontal

American Schless Corp., 1232 Penn Ave., Pittsburgh 22, Pa.
Bullard Co., Bridgeport 6, Conn.
Cincinnati Gilbert Machine Tool Co., 3366 Beekman St., Cincinnati 23, Ohio.
Consolidated Mch. Tool Div., 565 Blossom Rd., Rochester 10, N. Y.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Esch-Lucas Machine Works, Front St. and Girard Ave., Philadelphia, Pa.
Giddings & Lewis Mch. Tool Co., Fond du Lac, Wis.
Gray, G. A., Co., 3611 Woodburn Ave., Cincinnati 7, Ohio.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Lucas Mch. Tool Div., New Britain Mch. Co., 12302 Kirby Ave., Cleveland 8, Ohio.
New Britain Mch. Co., New Britain, Conn.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.

BORING MILLS, Vertical

American Schless Corp., 1232 Penn Ave., Pittsburgh 22, Pa.
Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio.
Bullard Co., 286 Canfield Ave., Bridgeport 6, Conn.
Consolidated Mch. Tool Div., 565 Blossom Rd., Rochester 10, N. Y.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Giddings & Lewis Mch. Tool Co., Fond du Lac, Wis.
New Britain Mch. Co., New Britain, Conn.
Portage Mch. Co., 1025 Sweitzer Ave., Akron 11, Ohio.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Triplex Machine Tool Corp., 75 West St., New York 6, N. Y.

(Continued on page 321)



BLISS HIGH PRODUCTION PRESSES "do-it-themselves" at Black and Decker

Just three Bliss High Production Presses produce the millions of motor laminations Black and Decker uses in its complete line of more than 150 portable power tools!

Running in the upper speed range, sometimes at well above 250 strokes per minute, through two shifts a day—and occasionally three. And they've been doing it for a long time now with no problems.

Of course, H-P presses are built for speed. Extra heavy cast Meehanite frame • Square gibbing • Automatic lubrication • Variable speed drive • Special air friction clutch • Counterbalanced crankshaft. Every feature has been especially designed to maintain precision at top speeds.

That adds up to top production rates, longer die life.

Another plus, users tell us, is the wide open die area that makes quick set-up and changeover possible. In fact, the fast set-up makes *short-run* work practical with Bliss H-P Presses. And the room *under* the press is a handy place to run chutes or store tote boxes.

If production of short-stroke stamped parts is your problem, long run or short, you'll want to learn more about Bliss H-P presses. Our recently revised 32-page catalog No. 27-C describes the entire line and gives examples of the wide range of work you can accomplish with these presses. Why not write for a copy today.

BLISS

SINCE 1857

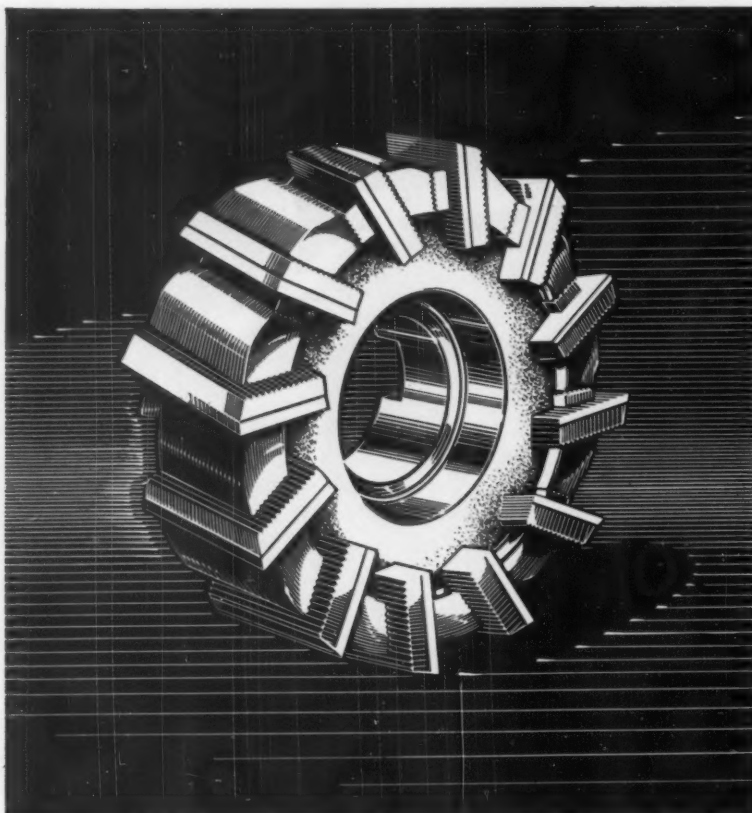
is more than a name... it's a guarantee

U. S. Plants in Canton, Cleveland, Salem and Toledo, Ohio; Detroit and Hastings, Michigan; Midland and Pittsburgh, Pa.; San Jose, California; Branch Offices in Boston, Burbank, Chicago, Cleveland, Dayton, Detroit, Indianapolis, New Haven, New York, Philadelphia, Rochester, San Jose, Salem, Toledo, Washington, D. C.; and Toronto, Ontario, Canada; E. W. Bliss (England) Ltd., Derby; E. W. Bliss Co. (Paris), France. Other representatives throughout the world.

E. W. BLISS COMPANY, CANTON, OHIO • Presses, Rolling Mills, Rolls, Special Machinery

For more information fill in page number on Inquiry Card, on page 273

MACHINERY, November, 1956—319



A VERSATILE MILLING CUTTER?

Sure, that's the best description you could apply to a Go & Go inserted high-speed steel blade milling cutter. Here's a tool that's equally at home banging out high production day after day or down in the toolroom carefully carving out a new die. And you can use it on almost any material.

When blades wear, and they do, it's a simple matter to set them out, sharpen and put the cutter back in production. After you've squeezed the last bit of tool life out of the blades, just order new ones from stock and insert them in the cutter body. Blade cost is so low most shops keep several sets on hand all the time.

You can choose just about any style and size of inserted HSS blade milling cutter you'll ever need from the complete line of standards manufactured and stocked by Go & Go. For specifications, ask for Catalog "F". Go & Go also designs and manufactures special milling cutters in quantity. Check your nearest Go & Go representative for details.



GODDARD & GODDARD COMPANY

DETROIT 23, MICHIGAN

Engineering and producing tools that Go & Go since 1917.

BORING TOOLS

American Schiess Corp., 1232 Penn Ave., Pittsburgh 22, Pa.
Apex Tool & Cutter Co., Inc., 235 Canal St., Shelton, Conn.
Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Bullard Co., 286 Canfield Ave., Bridgeport 6, Conn.
Crucible Steel Co. of America, Henry W. Oliver Bldg., Mellon Sq., Pittsburgh 22, Pa.
Davis Boring Tool Div., Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Eclipse Counterbore Co., 1600 Bonner Ave., Detroit 20, Mich.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Metallurgical Products Dept. of General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Portage Machine Co., 1025 Sweitzer Ave., Akron 11, Ohio.
Pratt & Whitney Co., Inc., West Hartford, Conn.
Scully-Jones & Co., 1906 Rockwell St., Chicago 8, Ill.
Star Cutter Co., 34500 Grand River, Farmington, Mich.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

BRAKES, Press and Bending

Bath, Cyril Co., 32324 Aurora Road, Solon, Ohio.
Cincinnati Shaper Co., Hopple & Gerrard, Cincinnati, Ohio.
Cleveland Crane & Engrg. Co., Wickliffe, Ohio.
Dreis & Krump Mfg. Co., 7400 Loomis Blvd., Chicago 36, Ill.
Ferracute Machine Co., Bridgeton, N. J.
Lodge & Shipley Co., Hamilton 1, Ohio.
Niagara Mch. & Tool Wks., 637 Northland Ave., Buffalo 11, N. Y.
Verson Allsteel Press Co., 93rd St. and S. Kenwood Ave., Chicago, Ill.

BRASS

American Brass Co., 25 Broadway, New York, N. Y.
Bridgeport Brass Co., Bridgeport, Conn.
Mueller Brass Co., Port Huron 35, Mich.
Revere Copper & Brass, Inc., 230 Park Ave., New York, N. Y.

BROACHES

American Broach & Mch. Co., Ann Arbor, Mich.
Colonial Broach & Machine Co., P. O. Box 37, Harper Sta., Detroit 13, Mich.
Detroit Broach Co., Inc., 950 S. Rochester Rd., Rochester, Mich.
duMont Corp., Greenfield, Mass.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Lapointe Mch. Tl. Co., Tower St., Hudson, Mass.
Metallurgical Products Dept. of General Electric Co., Box 237 Roosevelt Park Annex, Detroit 32, Mich.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.
Sundstrand Mch. Tool Co., 2531—11th St., Rockford, Ill.
Threadwell Tap & Die Co., 16 Arch St., Greenfield, Mass.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.

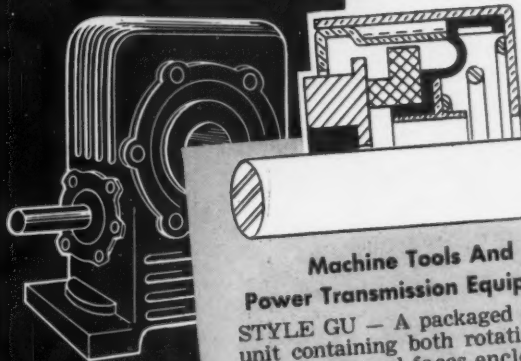
BROACHING MACHINE, Internal

American Broach & Mch. Co., Ann Arbor, Mich.
Colonial Broach & Machine Co., P. O. Box 37, Harper Sta., Detroit 13, Mich.
Detroit Broach Co., Rochester, Mich.
Lapointe Mch. Tl. Co., Tower St., Hudson, Mass.
Sundstrand Mch. Tool Co., 2531—11th St., Rockford, Ill.
Wilson, K. R., Inc., 211 Mill St., Arcade, N. Y.

BROACHING MACHINE, Surface

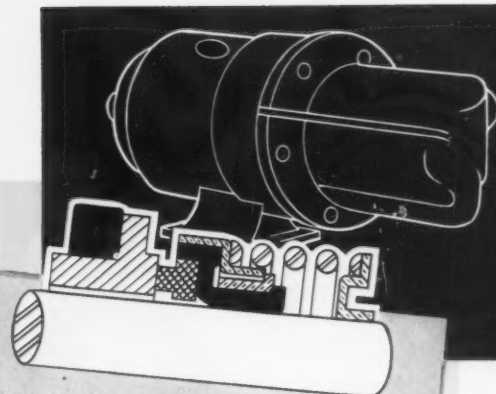
American Broach & Mch. Co., Ann Arbor, Mich.
Cincinnati Milling and Grinding Mchs., Inc., Cincinnati, Ohio.
Colonial Broach & Machine Co., P. O. Box 37, Harper Sta., Detroit 13, Mich.
Detroit Broach Co., Rochester, Mich.

(Continued on page 322)



Machine Tools And Power Transmission Equipment

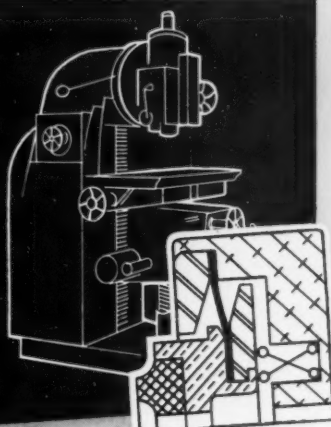
STYLE GU — A packaged sealing unit containing both rotating and stationary seal faces enclosed in metal housing. Stock sizes for shafts .250 through 4.000.



Pumps And Compressors

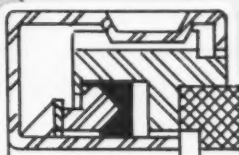
ROTO-FLEX — Rugged flexibility. Only 3 parts. Single or double units. Stock sizes for shafts .250 through 4.000.

STYLE RFO — A specially designed Roto-flex seal, for installation outside the stuffing box. Stock sizes for shafts .250 through 4.000.



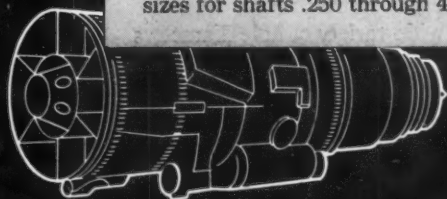
Heavy Machine Tools

STYLE DPC — A high-speed, carbon-faced seal, for more compact installation in heavy industrial machinery. Stock sizes for shafts .250 through 4.000.



Aircraft Engines And Accessories

STYLE HH — Absolute minimal space (both radial and axial) under extreme conditions of temperature, pressure and seal face surface speed. Features pressure balance when fluid pressure is applied internally or externally. Stock sizes for shafts .250 through 4.000.



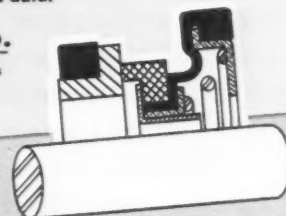
A Complete Line **GITS SHAFT SEALS** For Every Application

These modern, mechanical, face-type seals are carried in stock — to save you time and money. Write for detailed data.

GITS BROS. MFG. CO.

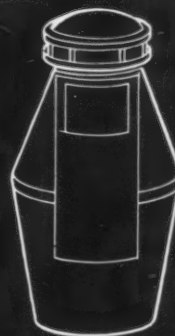
1858 South Kilbourn Avenue • Chicago 23, Illinois

Specialists In Lubricating Devices And
Shaft Seals For Almost Half-A-Century



Household Appliances

STYLE SGU — A factory-assembled unit-type seal for the small-budget user. Stock sizes for shafts .250 through 1.000.



Now
Available
from
Le Blond...

No. 30 Rapid Borer

*to Bore Holes Faster
than Ever Before*

With the new LeBlond-Carlstedt Rapid Borer, you can bore, trepan or counterbore holes *3 to 8 times faster than by the conventional D-bit method!*

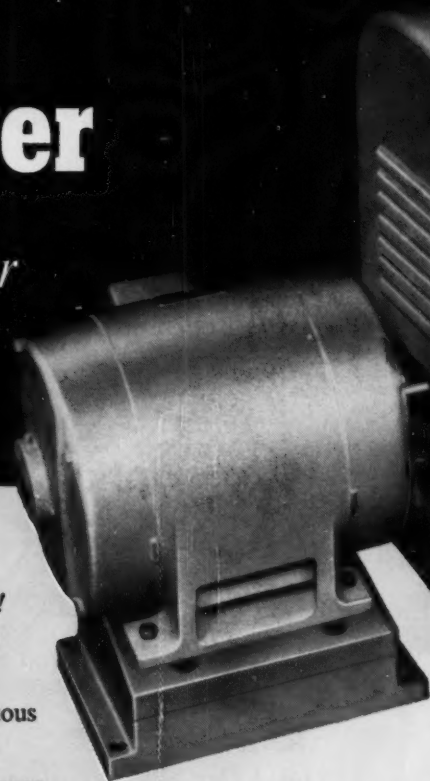
The Rapid Borer was developed expressly to accommodate revolutionary new tooling which cuts at very high speed with good accuracy and finish. Cutting oil is forced between the boring bar and hole wall forming a continuous bearing. It flushes back through a hole in the boring head and bar, carrying away the chips as it goes. Chip form is controlled both by tool angles and proper feed and speed combinations; thus tool faces are kept clean and chip passage clear. Cutter design produces balanced cutting pressures thereby controlling concentricity.

This new tooling requires a machine with the following characteristics, all of which are incorporated in the LeBlond Rapid Borer design:

- High spindle horsepower*
- Ample rigidity throughout*
- Complete absence of vibration at all speeds*
- Infinitely-variable feeds (up to 38" per minute), independent of speeds, while running under load*
- Final drive to spindle through belts*
- Large volume of cutting oil*

Basically, the Rapid Borer is suited to work that is symmetrical for balance in rotation—round, square, octagonal, tapered or stepped. A wide variety of hole diameters and depths as well as work sizes can be accommodated.

Tell us about the holes you'd like to produce faster. Large holes or small. If the Rapid Borer can handle the job, we'll show you how to produce them faster than ever before.





BRIEF SPECIFICATIONS, No. 30 RAPID BORER

Workpiece diameter..... $\frac{3}{4}$ " to $6\frac{1}{8}$ "
 Boring and workpiece lengths (max.).... 18", 42" or 66"
 Solid boring..... $\frac{1}{2}$ " to $1\frac{1}{4}$ "

Trepanning or counterboring..... $2\frac{3}{8}$ " max.
 Spindle speeds..... Single speed or variable
 to 2500 rpm
 Main drive motor..... 30 hp

EXAMPLES OF WORK BORED IN OUR SHOP

1. Drive Shaft, $29\frac{1}{2}$ " x $2\frac{3}{8}$ "
 Blind hole, 25" deep, .887" dia.
 Material, 4140
 Penetration rate, $6\frac{1}{4}$ "/min.
 Floor-to-floor, 5.5 minutes
 Old method* floor-to-floor, 29.2 min.

2. Barstock, $13\frac{1}{8}$ " x $2\frac{3}{8}$ "
 Through hole, 1.062" dia.
 Material, C1141
 Penetration rate, $7\frac{1}{4}$ "/min.
 Floor-to-floor, 3.2 min.
 Old method* floor-to-floor, 19.4 min.

3. Barstock, $10\frac{1}{8}$ " x $2\frac{3}{8}$ "
 Through hole, .775" dia.
 Material, C1141
 Penetration rate, 7"/min.
 Floor-to-floor, 3.03 min.
 Old method* floor-to-floor, 14 min.

* Old method—conventional D-bit

...cut with confidence

The R. K. LeBlond Machine Tool Company

Cincinnati 8, Ohio

*World's Largest Builder of
 a Complete Line of Lathes for
 more than 69 Years*



**GUARANTEED ACCURACY**

—as attained with any of the 7 SIP JIG BORERS and SIP OPTICAL JIG BORING, MILLING and MEASURING MACHINES—will furnish your plant with the permanent means (1) to define, establish and maintain the highest possible precision standards in your manufacturing processes, so as (2) to improve your quality-of-output and economy-of-operation. These and other profit-advantages are interestingly demonstrated in the film offered below.

FREE Showing 16mm. Sound Film

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100 East 42 Street, New York 17, N. Y.

Please arrange, with no obligation, for a free group showing at my plant of your 25 minute, 16mm. sound film, "Production with Precision."

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Sundstrand Mch. Tool Co., 2531—11th St., Rockford, Ill.

BRONZE

American Brass Co., Waterbury 20, Conn.
American Crucible Products Co., 1395 Oberlin Ave., Lorain, Ohio.
Bridgeport Brass Co., Bridgeport, Conn.
Mueller Brass Co., Port Huron 35, Mich.

BRUSHES, Industrial, Tampico, Wire Wheel, Etc.

Delta Power Tool Div., 400 N. Lexington Ave., Pittsburgh 8, Pa.
Osborn Mfg. Co., 5401 Hamilton Ave., Cleveland, Ohio.

BUFFERS

Delta Power Tool Div., 400 Lexington Ave., Pittsburgh 8, Pa.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio.

BULLDOZERS, Metalforming

Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa.
Erie Foundry Co., Erie, Pa.
Farquhar Div., A. B., 142 N. Duke St., York, Pa.
Lake Erie Engineering Corp., 470 Woodward Ave., Buffalo 17, N. Y.

BURNISHING MACHINES

Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio.
Russell, Holbrook & Henderson, Inc., 292 Madison Ave., New York 17, N. Y.

BURRING MACHINES—See Deburring Machines**BURRS—See Files and Burrs, Rotary****BUSHINGS, Drill Jig**

Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Metal Carbides Corp., 6001 Southern Blvd., Youngstown 12, Ohio.
Universal Engrg. Co., Frankenmuth, Mich.

BUSHINGS, Hardened Steel

Brown & Sharpe Mfg. Co., Providence, R. I.
Universal Engrg. Co., Frankenmuth, Mich.

BUSHINGS, Non-ferrous and Powdered Metal

American Crucible Products Co., Lorain, Ohio.
Bunting Brass & Bronze Co., 715 Spencer, Toledo, Ohio.
Universal Engrg. Co., Frankenmuth, Mich.

CABINETS, Tool

Brown & Sharpe Mfg. Co., Providence, R. I.
Standard Pressed Steel Co., Jenkintown, Pa.

CALIPERS, Spring, Firm-Joint, Transfer, Termaphrodite, etc. —See Layout and Drafting Tools; Machinists' Small Tools**CALIPERS, Vernier**

Brown & Sharpe Mfg. Co., Providence, R. I.
DoAll Co., Des Plaines, Ill.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Starrett, The L. S. Co., Athol, Mass.

(Continued on page 326)

PRICE is a RESULT not a point of DEPARTURE



Anthony Lucas

METHODS MGR., THE CINCINNATI GEAR CO.

My department is called "Methods," but it actually covers a lot more ground than the title would indicate to the average person. Methods' task is to carefully plan each job that is to go through our plant . . . lay out the operations required, in order and through the various machines indicated for that particular job . . . choose the correct material, in the correct form, and the type of blank for the job . . . determine the type of heat treating or finishing required . . . estimate the time involved for each operation, the cost of each ingredient in the manufacturing process.

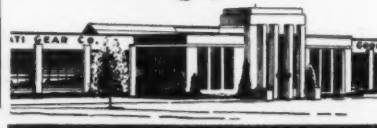
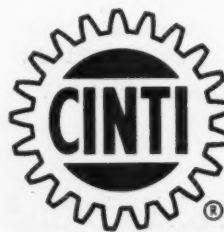
After all this is completed, and *only* after it is all completed, then we give our Sales Representative a price to quote to you the customer. All this must be done before we have any assurance that your order will be placed with us.

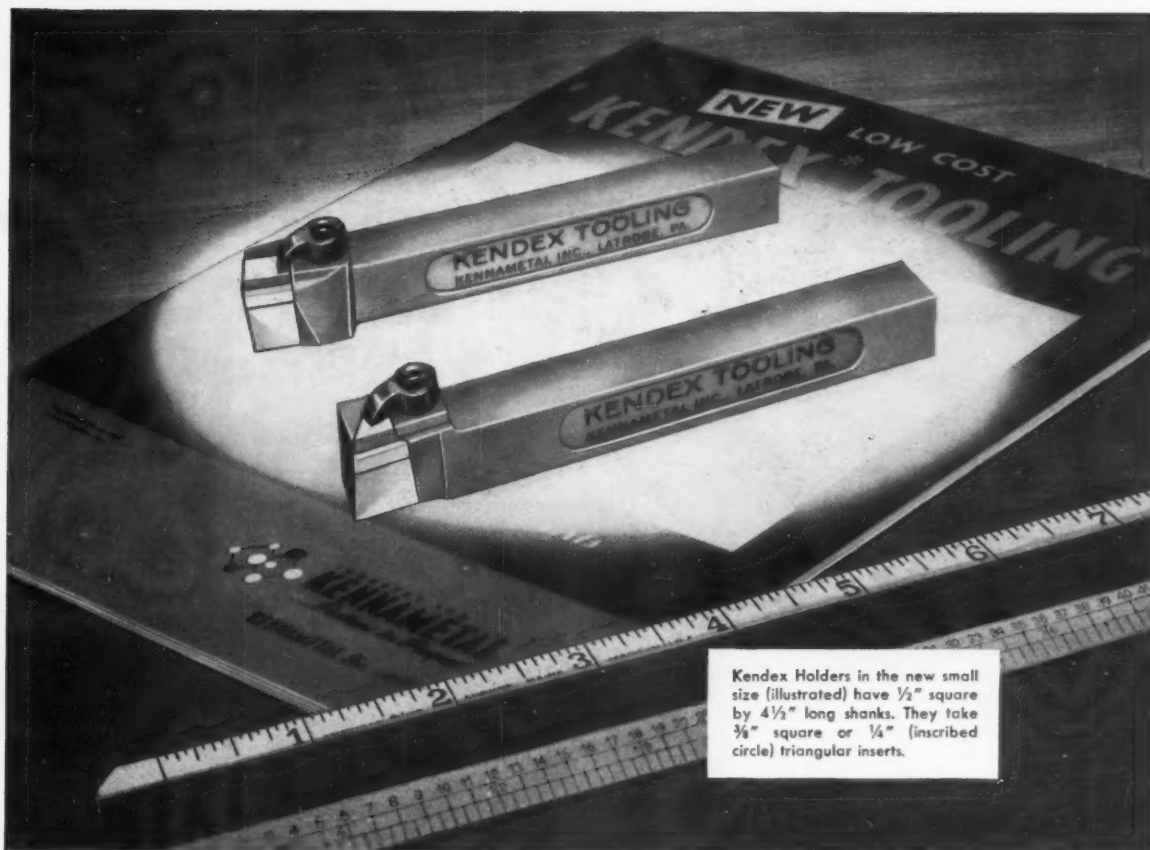
We never "guesstimate" a price; and once we receive your order, we are not compelled to resort to juggling to make the final price come out like the quote. It is my responsibility to make certain that our quote will reflect the *actual cost* of what we feel will be the right gear for the job—made of materials and by a sequence of operations that will produce for your particular application the gear of *lowest ultimate cost*.

THE CINCINNATI GEAR CO.

CINCINNATI 27, OHIO

"Gears—Good Gears Only"





NOW, small Kendex* Button Tools with turnover "throw-away" inserts

...for light machining on high production operations
...especially useful for boring operations

Another variation of the popular Kendex Tooling is now available. This is the new $\frac{1}{2}$ " Kendex Holder, available in four styles, for use with triangular or square Kennametal* "turn-over" button inserts . . . making available small tools with the many advantages and economies of the Kendex principle:

- grinding is eliminated
- inserts are indexed quickly to each new cutting edge
- machine downtime is reduced to a minimum
- production is increased

If you are interested in small-sized, rugged, dependable clamped-type tooling, ask your Kennametal tool engineer to show you how these small Kendex holders can be used to advantage on your operations. Or write for Booklet 301. KENNAMETAL INC., Latrobe, Pennsylvania.

*Registered Trademark

B-5975



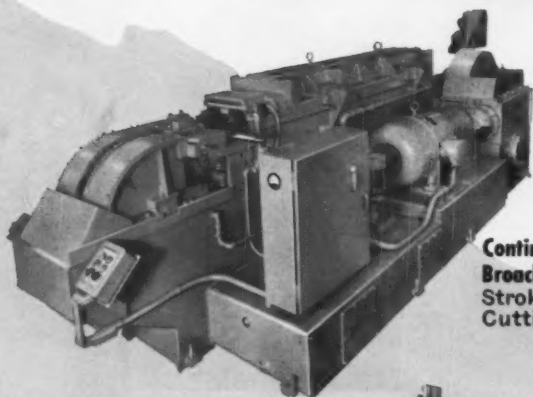
INDUSTRY AND
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...Partners in Progress



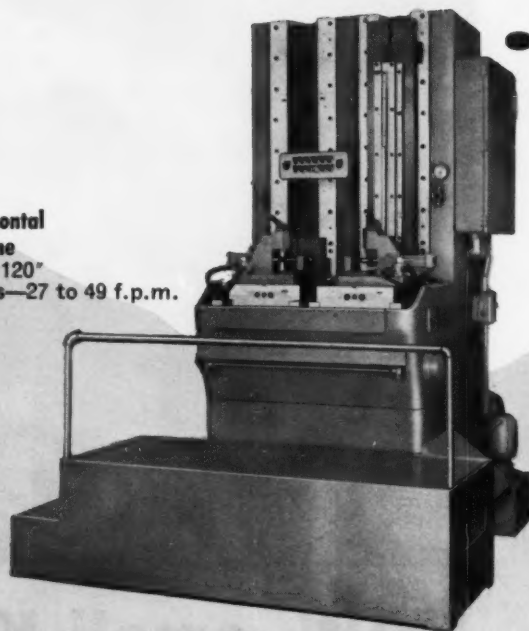
For more information fill in page number on Inquiry Card, on page 273

MACHINERY, November, 1956—325

Your Best Investment *and Tomorrow's* **for Today's Production**

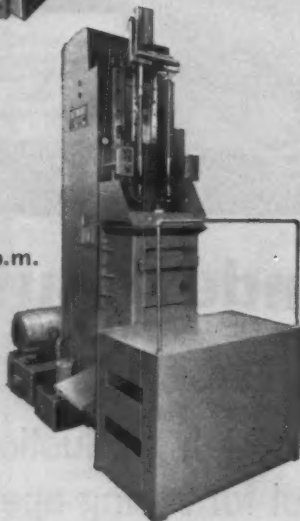


**Continuous Horizontal
Broaching Machine**
Stroke—42" to 120"
Cutting Speeds—27 to 49 f.p.m.

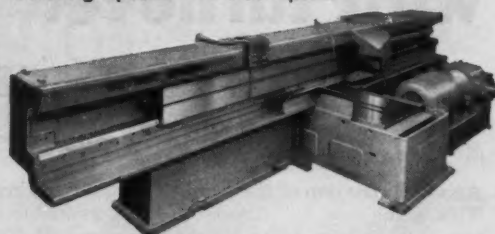


Vertical Twin Ram Broaching Machine
Capacity—5 to 25 tons
Stroke—30" to 100"
Cutting Speeds—4 to 35 f.p.m.

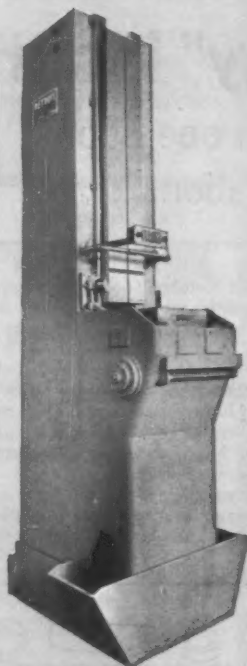
**Vertical Pull-Down
Broaching Machine**
Capacity—5 to 50 tons
Stroke—30" to 72"
Cutting Speeds—4 to 35 f.p.m.



**Vertical Single Ram
Broaching Machine**
Capacity—5 to 25 tons
Stroke—30" to 90"
Cutting Speeds—4 to 35 f.p.m.



Horizontal Surface Broaching Machine
Capacity—10 to 50 tons
Stroke—90" to 240"
Cutting Speeds—15 to 300 f.p.m.



Horizontal Internal Broaching Machine
Capacity—3 to 50 tons
Stroke—6" to 90"
Cutting Speeds—4 to 35 f.p.m.

NOTE—All capacities, strokes and cutting speeds given are for standard machines and will be varied to suit your requirements.

Requirements

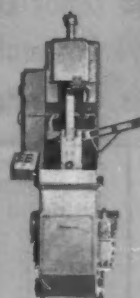
DETROIT Broaching Machines

You want machines for *today's* production to be rugged . . . built to deliver high output consistently, without costly shutdowns. *But look to the future as well!* Be sure that these machines are also designed with maximum versatility . . . so they'll be readily adaptable to model changes for *tomorrow's* production, too.

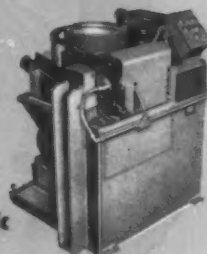
Detroit machines meet these requirements because they are:

- **RUGGED** . . . take overloads 50% over rated capacity.
- **FLEXIBLE** . . . easily retooled for part or model changes.
- **DEPENDABLE** . . . rigid construction and stabilized hydraulic circuits assure consistent high production.
- **SIMPLE** . . . easy to operate, easy to maintain.
- **VERSATILE** . . . available with manual, semi-automatic or full automatic control plus automatic tool handling.
- **PRECISE** . . . total ram runout less than .0005" through strokes as long as 100".
- **FOOLPROOF** . . . full interlocking protects machine and tooling. All electrical and hydraulic equipment to J.I.C. standards.

To make the best investment for today and tomorrow, consult our Engineering Department. They'll recommend the right high-capacity, high-performance Detroit machine to solve your problem, along with complete tooling and automation if required. Send parts, prints or details of your problem now.



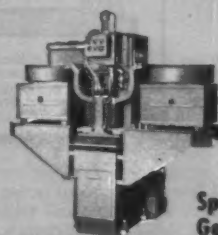
Automatic Side Plate Press



Special Automatic Assembly Press



Side Plate Press



Special Automatic Gooseneck Press

(Ask us to quote on any of your hydraulic press applications.)

DETROIT BROACH

& MACHINE COMPANY

DEPT. B-11

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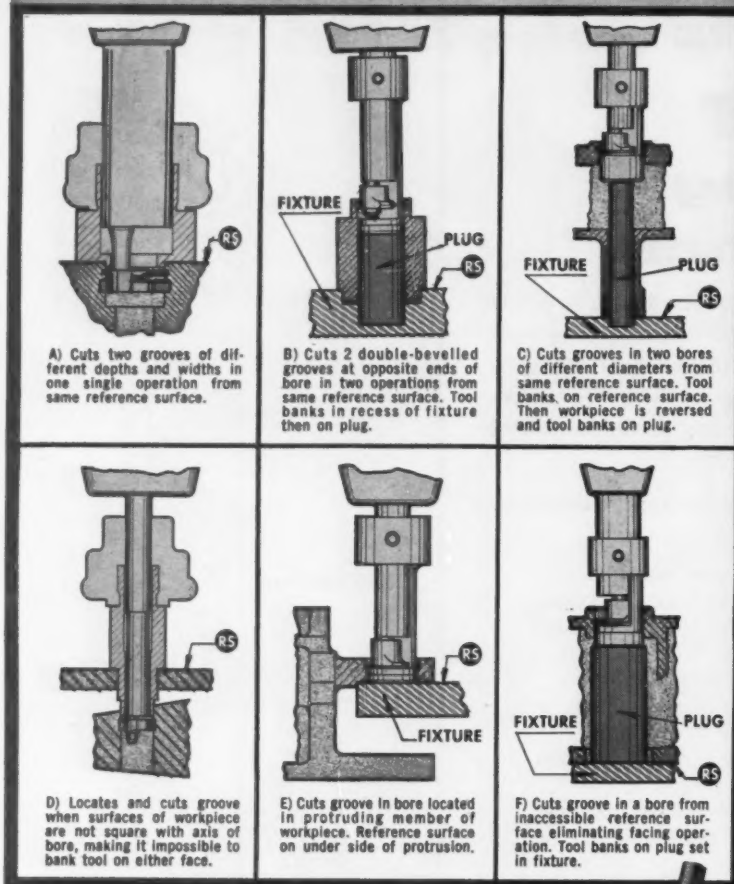
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COMPANY _____

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CITY _____ ZONE _____ STATE _____

Even Unskilled Labor Can Use This Versatile Tool Accurately! It Simplifies Internal Grooving Problems, Cuts Production Costs!



Amazingly versatile! Your toughest recess cutting problems can be met simply and efficiently with the Waldes Truarc Grooving Tool because it offers a whole range of possibilities beyond the range of ordinary recessing tools.

Wide Cutting Range! The Waldes Truarc Grooving Tool comes in 5 models...enabling you to cut accurate grooves in housings with diameters from .250 to 5.00 inches.

Send Your Problems to Waldes! Send us your blueprints...let Waldes Truarc Engineers give you a complete analysis, price quotation and delivery information on the most economical tool set-up for your particular job. There is no obligation!

Write NOW for a 20-page manual containing full information on Waldes Truarc Grooving Tool



WALDES
TRUARC
GROOVING TOOL

Made by the Manufacturers of Waldes Truarc Retaining Rings
WALDES KUHNOOR, INC., 47-16 Austel Place, L.I.C. 1, N.Y.

Waldes Truarc Grooving Tool Manufactured
Under U. S. Pat. 2,411,426

Waldes Kuhnour, Inc., 47-16 Austel Pl., L.I.C. 1, N. Y.

Please send me your new 20-page technical manual on the Waldes Truarc Grooving Tool. (M 118)

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Title _____

Company _____

Address _____

City _____ Zone _____ State _____

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Pratt & Whitney Co., Inc., West Hartford, Conn.
Russell Holbrook & Henderson, Inc., 292 Madison Ave., New York 17, N. Y.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
Van Norman Mch. Co., 3640 Main St., Springfield 7, Mass.

CAM MILLING AND GRINDING MACHINES

American Schless Corp., 1232 Penn Ave., Pittsburgh 22, Pa.
Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Cincinnati Milling Machine Co., Oakley, Cincinnati, Ohio.
Landis Tool Co., Waynesboro, Pa.
Rowbottom Machine Co., Waterbury, Conn.

CAMS

Brown & Sharpe Mfg. Co., Providence, R. I.
Eisler Engrg. Co., Inc., 750 S. 13th, Newark 3, N. J.
Rowbottom Machine Co., Waterbury, Conn.

CARBIDES

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Besley-Wells Corp., 112 Dearborn Ave., South Beloit, Ill.
Chicago-Latrobe Twist Drill Wks., 411 W. Ontario St., Chicago 10, Ill.
DoAll Co., Des Plaines, Ill.
Kennametal, Inc., Latrobe, Pa.
Linde Air Products Co., 30 E. 42nd St., New York 17, N. Y.
Metal Carbides Corp., Youngstown, Ohio
Metallurgical Products Dept. of General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.

CASTINGS, Die

American Brass Co., Waterbury 20, Conn.
Madison-Kipp Corp., Madison, Wis.

CASTINGS, Non-ferrous

American Crucible Products Co., Lorain, Ohio
Bethlehem Steel Co., 701 East Third St., Bethlehem, Pa.
Centrifugally Cast Products Div.—Shenango Furnace Co., Dover, Ohio
Dow Chemical Co., Midland, Mich.
Mueller Brass Co., Port Huron 35, Mich.

CASTINGS, Gray Iron, Malleable

Bethlehem Steel Co., 701 East Third St., Bethlehem, Pa.
Centrifugally Cast Products Div.—Shenango Furnace Co., Dover, Ohio
Challenge Mchry. Co., Grand Haven, Mich.
Farrel-Birmingham Co., Inc., Ansonia, Conn.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

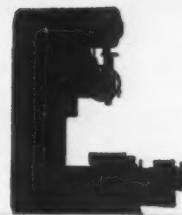
CASTINGS, Steel, Stainless, etc.

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Bethlehem Steel Co., 701 East Third St., Bethlehem, Pa.
Birdsboro Steel Fdry. & Mch. Co., Birdsboro, Pa.
Crucible Steel Co. of America, Henry W. Oliver Bldg., Pittsburgh 22, Pa.
Farrel-Birmingham Co., Inc., Ansonia, Conn.

CEMENT, Abrasive Disc

Delta Power Tool Div., 400 N. Lexington Ave., Pittsburgh 8, Pa.
Walls Sales Corp., 333 Nassau Ave., Brooklyn 22, N. Y.

(Continued on page 330)



NEW QUILL BEARING DESIGN

**helps achieve
extreme precision in
Fosmatic Jig Borer**

To bore with precision as close as $\pm .0001"$, distance between cutting tool and lower quill bearing must be held to a minimum. Here's how Fosdick minimizes this crucial distance.

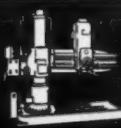
The lower quill bearing is *permanently* located at the lowest possible position in the head, permits boring with spindle nose as close as $2\frac{1}{2}"$ to the bearing. Bearing does not ride up and down with quill and spindle as in conventional designs where balls are held in moving bushings.

The permanent location of quill bearings is made possible by unique Fosdick design—vertical ball races with preloaded precision balls circulating continuously. This design also permits spindle and quill to be shorter; thus stronger and more rigid. Both are perfect cylinders with no cuts on the outside.

Engineering advancements like this make the Fosmatic Jig Borer the most rigid and precise boring machine you can buy. Write today for the new catalog.

Eight models available from the low-cost Model 30 with 36" x 18" table, to the virtually automatic model 54P with 54" x 22" table. Other important features: Automatic Positioning, choice of two precision measuring systems, milling feed, rapid traverse to quill, power clamping of table and saddle, coolant system and reversing motor control for tapping.

NEED JIG BORING EQUIPMENT? GET A PROPOSAL FROM FOSDICK!



Fosmatic
Radial Drills



Jig
Borers



Sensitive and
Upright Drills



Sensitive
Radial Drills



Jig
Grinders



Automatic Positioning
Jig Borers

FOSDICK

THE FOSDICK MACHINE TOOL CO., CINCINNATI 23, OHIO

BETTER SERVICE on STAMPINGS is as simple as 1

A FEW
PIECES
—at
Experimental
or Pilot
Stage

SHORT
RUNS

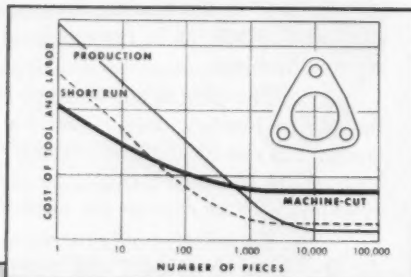
PRODUCTION
RUNS

Our ability to use the best of three stamping techniques, each our own exclusive development, assures lowest possible cost on any quantity—one to a million or more.

NO DIES! Our machine cut method, applying custom-built slitters, cutters, saws, files and stock punches—PLUS special techniques and skills—produce these small quantities at very low cost.

TEMPORARY LOW-COST TOOLING! To produce something more than a few, but less than high production quantities, our simple contour dies—PLUS special purpose presses—keep costs low.

MODEST DIE CHARGES on larger quantities! Here is where our regular production toolings apply to advantage ...to deliver high quantity Stampings, and at lowest possible unit cost.



You can rely on it... WE LOOK AT ALL THREE—then determine the best method for fast, efficient, low-cost service. Let us quote on your next Stampings job.



Free 12-page booklet shows how to save on stampings...write for it.

STAMPINGS DIVISION

"One Piece or a Million"
3911 Union Street
Glenbrook, Conn.

CENTER-DRILLING MACHINES

Baker Brothers, Inc., 1000 Post St., Toledo 10, Ohio
La Salle Tool Inc., 3840 E. Outer Dr., Detroit 34, Mich.
Seneca Falls Mch. Co., Seneca Falls, N. Y.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

CENTER PUNCHES—See Machinists' Small Tools

CENTERS, Grinding Machines, Indexing Head and Lathe

Brown & Sharpe Mfg. Co., Providence, R. I.
Buck Tool Co., 220 Schippers Lane, Kalamazoo, Mich.
Metal Carbides Corp., Youngstown, Ohio
Metallurgical Products Dept. of General Electric Co., Box 237, Roosevelt Park Annex, Detroit, Mich.
Rivett Lathe & Grinder Inc., Brighton 35, Boston, Mass.
Scully Jones & Co., 1906 Rockwell St., Chicago 8, Ill.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

CERAMIC TOOL MATERIAL—See Tool Material, Ceramic

CHAINS, Power Transmission and Conveyor

Boston Gear Works, 14 Hayward St., Quincy 71, Mass.

CHUCKING MACHINES, Single-Spindle Automatic

Bullard Co., 286 Canfield Ave., Bridgeport 6, Conn.
Cleveland Automatic Machine Co., 4932 Beech St., Cincinnati 12, Ohio
Coulter, James Mch. Co., 629 Railroad Ave., Bridgeport 5, Conn.
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
Jones & Lamson Mch. Co., Springfield, Vt.
National Acme Co., 170 E. 131st St., Cleveland, Ohio
Potter and Johnson Co., 1027 Newport Ave., Pawtucket, R. I.
Reid Bros. Co., Inc., Beverly, Mass.
Russell Holbrook & Henderson, Inc., 292 Madison Ave., New York 17, N. Y.
Seneca Falls Mch. Co., Seneca Falls, N. Y.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 83, Ohio

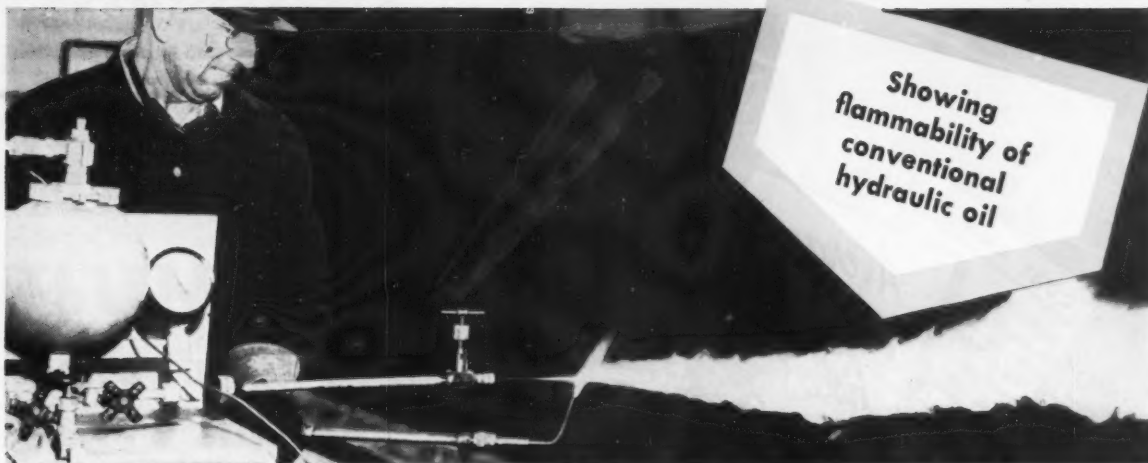
CHUCKING MACHINES, Multiple-Spindle Automatic

Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Bullard Co., 286 Canfield Ave., Bridgeport 6, Conn.
Cone Automatic Mch. Co., Inc., Windsor, Vt.
Cross Co., 3250 Bellevue Ave., Detroit 7, Mich.
Goss & DeLeeuw Mch. Co., Kensington, Conn.
National Acme Co., 170 E. 131st St., Cleveland, Ohio
New Britain Mch. Co., New Britain-Gridley Mch. Div., New Britain, Conn.
Olofsson Corp., 2729 Lyons Ave., Lansing, Mich.
Pratt & Whitney Co., Inc., West Hartford, Conn.
Warner & Swasey, 5701 Carnegie Ave., Cleveland 3, Ohio
Wickes Brothers, 512 No. Water St., Saginaw, Mich.

CHUCKS, Air Operated

Axelsson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Cal.
Buck Tool Co., 220 Schippers Lane, Kalamazoo, Mich.
Cushman Chuck Co., Windsor Ave., Hartford 2, Conn.
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.

(Continued on page S32)



Flame tests prove its fire-snuffing ability

**SHELL
IRUS
FLUID 902**

Entirely new formula: Shell Iru Fluid 902 is a special formulation . . . product of three years' development and field testing. It is suitable for nearly all industrial hydraulic systems, as a direct replacement for presently used oils. *Here is a fire-resistant hydraulic fluid that can be widely used.*

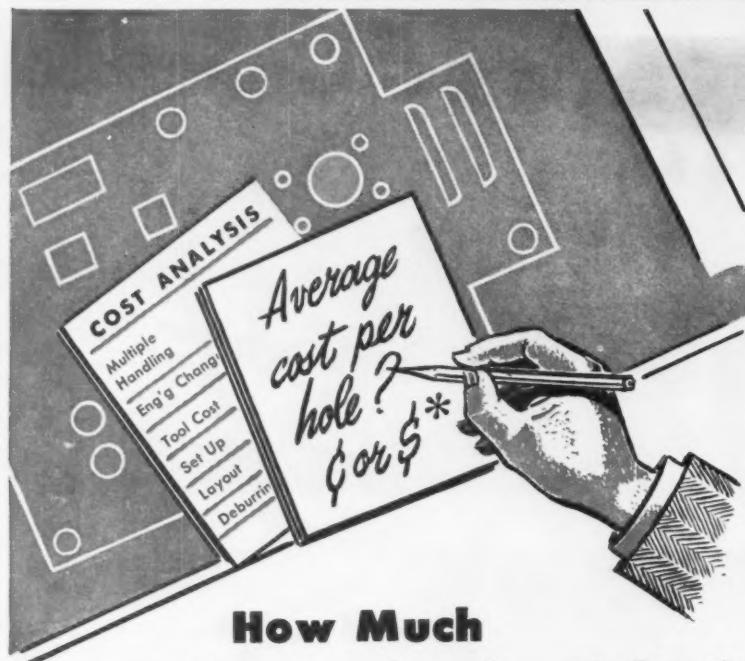
Non-corrosive: Shell Iru Fluid 902 contains no corrosive ingredients. It has no harmful effects on seals, fittings or bearings. It does not promote rust.

No major modification necessary . . . simply clean present fluid thoroughly out of system and replace directly with Shell Iru Fluid 902. You can use it with complete confidence. Write for test data and all information.

SHELL OIL COMPANY

50 WEST 50TH STREET, NEW YORK 20, NEW YORK
100 BUSH STREET, SAN FRANCISCO 6, CALIFORNIA



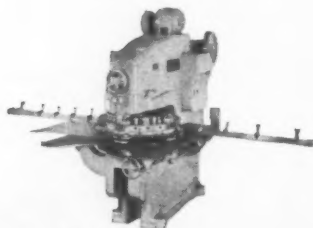


How Much Are You Paying for Holes?

Square holes . . . round holes . . . groups . . . louvers—the shape doesn't matter, but the number of pieces does. Producing holes in sheet metal or plate in small to medium production lots can be an expensive, time consuming job . . . unless you are using a Wiedemann Turret Punch Press.

With a Wiedemann, your short run piercing costs are cut 60 to 90%. The Wiedemann method eliminates both set up and layout—gives you almost unlimited versatility. The Wiedemann turrets carry all the punches and dies you need for a wide variety of jobs. Material is positioned quickly and accurately with a rapid-setting work locating gauge. This amazing Wiedemann method is so flexible that engineering changes can be made on the spot without costly production delays.

*For example, Wiedemann users are *selling* short run chassis work at 1¢ per hole. What are your hole costs? Send drawings of your work for a free time study and cost analysis by Wiedemann. Write for Bulletin 101.



From the small, hand operated R-2 to the 150-ton Turret Punch Press, there's a Wiedemann designed for your short run piercing needs.

WIEDEMANN MACHINE COMPANY

4205 Wissahickon Ave. P.O. Box 6794 Philadelphia 32, Pa.

Logansport Machine Co., Inc., 810 Center Ave., Logansport, Ind.
Schroders Son, A., 470 Vanderbilt Avenue, Brooklyn, N. Y.
Skinner Chuck Co., 95 Edgewood Ave., New Britain, Conn.
Tomkins-Johnson Co., Jackson, Mich.
Zagar, Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio

CHUCKS, Collet

Brown & Sharpe Mfg. Co., Providence, R. I.
Bryant Chucking Grinder Co., Clinton St., Springfield, Vt.
Chicago Tool & Engrg. Co., 8389 So. Chicago Ave., Chicago, Ill.
Cleveland Automatic Machine Co., 4932 Beech St., Cincinnati 12, Ohio
Cushman Chuck Co., 800 Windsor St., Hartford 2, Conn.
Delta Power Tool Div., 400 N. Lexington Ave., Pittsburgh 8, Pa.
Errington Mech. Lab. Inc., 24 Norwood Ave., Staten Island 4, N. Y.
Gisholt Mch. Co., 1245 E. Washington Ave., Madison 10, Wis.
Gorton Mch. Co., Geo., 1321 Racine St., Racine, Wis.
Hardinge Bros., Inc., 1420 College Ave., Elmira, N. Y.
Jacobs Mfg. Co., West Hartford 10, Conn.
Kearney & Trecker Corp., Milwaukee 14, Wis.
National Acme Co., 170 E. 131st St., Cleveland 8, Ohio
New Britain Mch. Co., New Britain-Gridley Mch. Div., New Britain, Conn.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Universal Engrg. Co., Frankenmuth 2, Mich.
Warner & Swasey, 5701 Carnegie Ave., Cleveland 3, Ohio

CHUCKS, Combination Universal-Independent

Cushman Chuck Co., 806 Windsor St., Hartford 2, Conn.
Gisholt Mch. Co., Madison 10, Wis.
Horton Chuck, Windsor Locks, Conn.
Kearney & Trecker Corp., Milwaukee 14, Wis.
National Acme Co., 170 E. 131st St., Cleveland 8, Ohio
Skinner Chuck Co., 95 Edgewood Ave., New Britain, Conn.

CHUCKS, Compensating

Cushman Chuck Co., 806 Windsor St., Hartford 2, Conn.
Logansport Mch. Co., Inc., Logansport, Ind.
Skinner Chuck Co., 95 Edgewood Ave., New Britain, Conn.

CHUCKS, Diaphragm

Bryant Chucking Grinder Co., Clinton St., Springfield, Vt.
Wadell Equip. Co., Terminal Ave., Clark, N. J.

CHUCKS, Drill, Key Type

Delta Power Tool Div., 400 Lexington Ave., Pittsburgh 8, Pa.
Jacobs Mfg. Co., West Hartford, Conn.
Supreme Products, Inc., 2222 So. Calumet Ave., Chicago 16, Ill.

CHUCKS, Drill, Keyless

Delta Power Tool Div., 400 Lexington Ave., Pittsburgh 8, Pa.
Jacobs Mfg. Co., West Hartford, Conn.
Scully-Jones & Co., 1906 Rockwell St., Chicago 8, Ill.
Supreme Products, Inc., 2222 So. Calumet Ave., Chicago 16, Ill.

CHUCKS, Full Floating

Errington Mechanical Laboratory, 24 Norwood Ave., Stapleton, Staten Island, N. Y.
Gisholt Mch. Co., Madison 10, Wis.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
Universal Engineering Co., Frankenmuth 2, Mich.

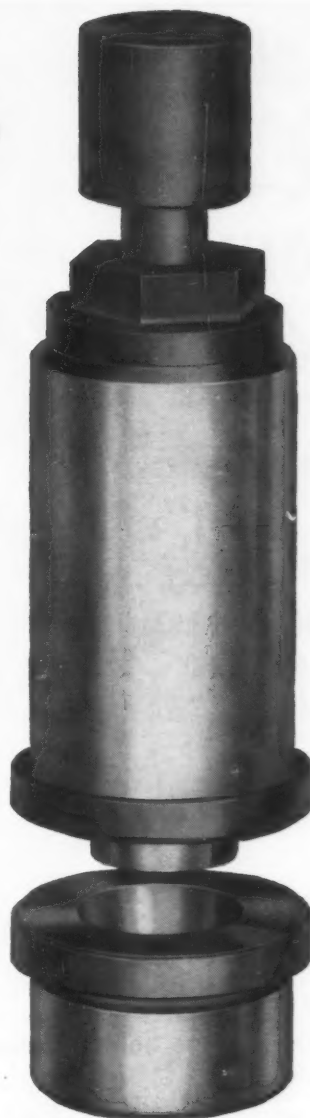
(Continued on page 334)

STANDARDIZED UNIVERSAL INDEX PLUNGERS

**SAVE TIME
SAVE MONEY**

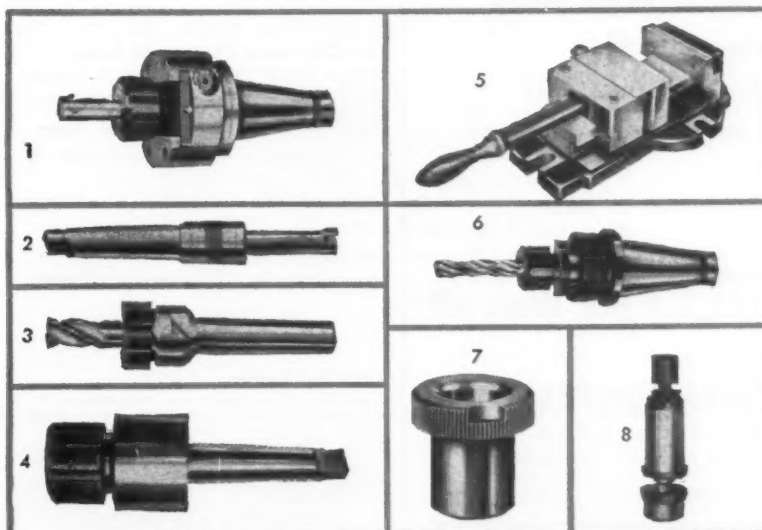
Universal's Straight and Taper Plungers made in standard sizes save the time and expense of designing and machining special index plungers for multi-station tools. They come to you complete, ready for installation at approximately $\frac{1}{4}$ the cost of specially made plungers.

Universal Plungers greatly simplify jig or fixture manufacture because plunger body and bushing have same diameter so that all holes can be bored with same tool, often in same setting.



Soft pin knob permits connection to actuating lever or air cylinders by several different methods. Locating bushing, plunger and plunger bushing are hardened and ground.

Plunger is easily assembled from either top or bottom. And it can be removed in either direction by removal of hex nut.



**UNIVERSAL
ENGINEERING
COMPANY**

**FRANKENMUTH 2
MICHIGAN**

- (1) BORING CHUCK
- (2) MIKRO-LOK BORING BAR
- (3) STANDARD COLLET CHUCK
- (4) FLOATING COLLET CHUCK
- (5) WEDGE-LOCK PRODUCTION VISE
- (6) "KWIK-SWITCH" TOOL HOLDER
- (7) STANDARD DRILL BUSHING
- (8) UNIVERSAL INDEX PLUNGER

168

ARTER JIGMATIC WILL DO *all* YOUR POSITIONING AND *do it fast*



**TAPE-CONTROLLED
AUTOMATIC
POSITIONING TABLE**

Check These Features...

- No stops
- No gauge rods
- Only SECONDS to change tapes
- MINUTES to set up
- No more than 11 tape holes to punch per position
- 600,000,000 possible positions. Hundreds of positions per single set-up
- Automatic magnetic locking
- Accuracy — plus or minus .001"
- Unidirectional approach at minimum speed
- Simultaneous operation of both coordinates

The 20"x30" **ARTER** has them all

ARTER GRINDING MACHINE COMPANY

WORCESTER 5, MASSACHUSETTS

Jigmatic Automatic Tape Controlled Positioning Table • Rotary Surface Grinders
Flat Circular Cutter Grinders • Internal Grinders • Cylindrical Grinders • Carbide Tool Grinders
AGENTS IN INDUSTRIAL CENTERS OF UNITED STATES AND CANADA

CHUCKS, Gear

Bryant Chucking Grinder Co., Clinton St. Springfield, Vt.
Cushman Chuck Co., 806 Windsor St., Hartford 2, Conn.
Horton Chuck, Windsor Locks, Conn.
Supreme Products, Inc., 2222 So. Calumet Ave., Chicago, Ill.

CHUCKS, Independent

Cushman Chuck Co., 806 Windsor St., Hartford 2, Conn.
Gisholt Mch. Co., Madison 10, Wis.
Homestrand, Inc., Larchmont, N. Y.
Horton Chuck, Windsor Locks, Conn.
Skinner Chuck Co., 95 Edgewood Ave., New Britain, Conn.

CHUCKS, Lathes, etc.

Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Cal.
Buck Tool Co., 220 Schippers Lane, Kalamazoo, Mich.
Bullard Co., Brewster St., Bridgeport 2, Conn.
Chicago Tool & Eng. Co., 8389 So. Chicago Ave., Chicago, Illinois (Milling Machine)
Cushman Chuck Co., Windsor Ave., Hartford 2, Conn.
Gisholt Mch. Co., Madison 10, Wis.
Horton Chuck, Windsor Locks, Conn.
Jacobs Mfg. Co., West Hartford, Conn.
Jones & Lamson Mch. Co., Springfield, Vt.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Skinner Chuck Co., 95 Edgewood Ave., New Britain, Conn.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Standard Tool Co., 3950 Chester Ave., Cleveland, Ohio.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 3, Ohio.
Zagar, Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio

CHUCKS, Magnetic

Brown & Sharpe Mfg. Co., Providence, R. I.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Hanchett Magna-Lock Corp., Big Rapids, Mich.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
Walker, O. S., Co., Inc., Worcester, Mass.

CHUCKS, Power Operated

Cushman Chuck Co., 806 Windsor St., Hartford 2, Conn.
Gisholt Mch. Co., Madison 10, Wis.
Logansport Mch. Co., Inc., Logansport, Ind.
Skinner Chuck Co., 95 Edgewood Ave., New Britain, Conn.

CHUCKS, Quick Change and Safety

Chicago Tool & Engrg. Co., 8389 So. Chicago Ave., Chicago, Ill.
Jacobs Mfg. Co., West Hartford 10, Conn.
McCroskey Tool Corp., Meadville, Pa.
Scully-Jones & Co., 1906 Rockwell St., Chicago 8, Ill.
Universal Engineering Co., Frankenmuth 2, Mich.

CHUCKS, Ring Wheel

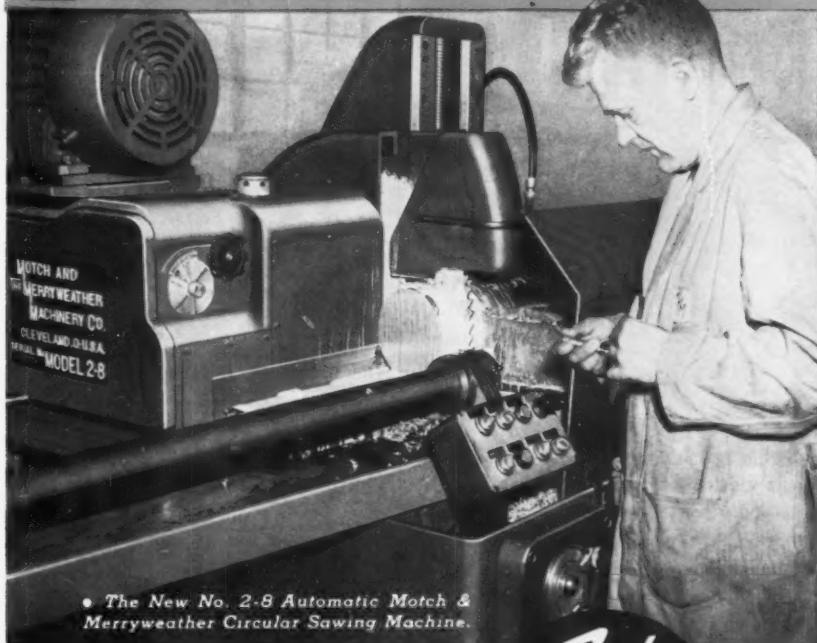
Gardner Mch. Co., 414 E. Gardner St., Beloit, Wis.

CHUCKS, Tapping

DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Errington Mechanical Laboratory, 24 Norwood Ave., Stapleton, Staten Island, N. Y.
Jacobs Mfg. Co., West Hartford, Conn.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
Skinner Chuck Co., 95 Edgewood Ave., New Britain, Conn.

(Continued on page 336)

STEP UP Metal-Sawing Production in ALL of 7 ways:



• The New No. 2-8 Automatic Motch & Merryweather Circular Sawing Machine.

1. LESS TIME
2. LOWER TOOL COST
3. MILLED FINISH
4. BURRLESS ENDS
5. NEGLIGIBLE WASTE
6. PERFECT PARALLELISM
7. ACCURATE LENGTHS

THE MOTCH & MERRYWEATHER



DOES JUST THAT!

CAN YOU EQUAL THIS **{ TIME COST }**
BY ANY OTHER METHOD?



Material —
5" dia. SAE 1020
Cutting time —
54 seconds
Tool cost per
piece — \$.019
IMPORTANT: Re-
sharpening costs
and all other tool
costs are included.

ALWAYS — it's your cost per cut that counts. To determine that cost, all seven yardsticks listed above must be applied. You must increase usable production, get uniform accuracy, and reduce sawing costs. The Motch & Merryweather Triple-Chip Method out-performs and out-saves all others in the sawing of metal. Let us convince you.

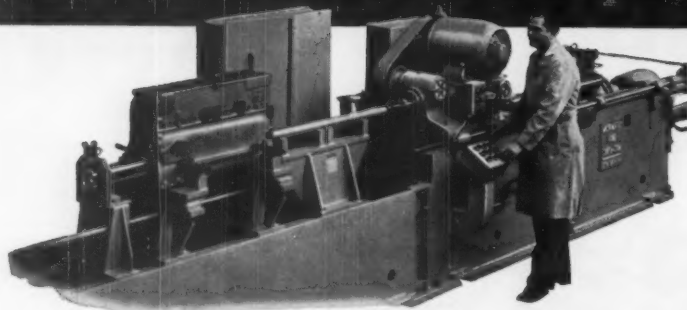
**THE
MOTCH & MERRYWEATHER
MACHINERY Co.**

MACHINERY MANUFACTURING DIVISION

CLEVELAND 13, OHIO

BUILDERS OF AUTOMATIC PRECISION CUT-OFF, MILLING, AND SPECIAL MACHINERY

WHY CUMMINS main bearings are MICROHONED

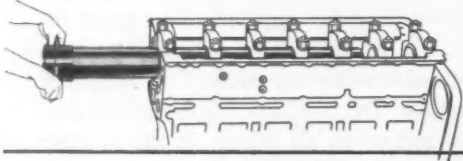


"Cummins diesel engines have a world-wide reputation for dependable, low-cost power. Here at Cummins, we attribute the wide acceptance of our engines to constant searching for better processing methods and improved engine performance.

"For example, if our crankshaft main bearings were undercut at the ends, tapered or out-of-round, then the full load of the journals would be borne by relatively small areas. This would cause bearing inserts to overheat and quickly break down. Also, should the bearings be misaligned, the crankshaft would flex during rotation and cause fatigue failure.

"However, by Microhoning our main bearings we secure round, accurately-sized and aligned bores. Cummins is the first diesel manufacturer to Microhone its main bearings. The surfaces of Microhoned bearings are clean-cut, free of deformed metal and the finish is consistent in every bore. In addition, the consistent accuracy generated by Microhoning permits us to make faster set-ups and use higher cutting feeds on preceding boring operations—Microhoning automatically corrects all inaccuracies.

"After Microhoning, all main bearing bores are checked with a gage plug 44 inches long and .0007 inch under required bore size. Gage must have a simultaneous slip-fit through all bores in the block. Tolerance for roundness is less than .0002 inch and finish is held to the specified 55 microinches."



Learn how Microhoning will give you efficient stock removal, closer tolerances, accurate alignment and functional surfaces.

- ☐ Please have a Micromatic Field Engineer call.
- ☐ Please send Micromatic literature and case histories.

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TITLE _____

COMPANY _____

STREET _____

CITY _____

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STATE _____

MICROMATIC HONE CORP.

8100 SCHOOLCRAFT AVENUE • DETROIT 38, MICHIGAN



CHUCKS, Universal Three-Jaw

Cushman Chuck Co., 806 Windsor St., Hartford 2, Conn.
Delta Power Tool Div., 400 Lexington Ave., Pittsburgh 8, Pa.
Gisholt Mch. Co., Madison 10, Wis.
Homestrand, Inc., Larchmont, N. Y.
Horton Chuck, Windsor Locks, Conn.
Kearney & Trecker Corp., Milwaukee 14, Wis.
Logansport Mch. Co., Inc., Logansport, Ind.
Skinner Chuck Co., 95 Edgewood Ave., New Britain, Conn.
Warner & Swasey, 5701 Carnegie Ave., Cleveland 3, Ohio

CHUCKS, Wrenchless

Gisholt Mch. Co., Madison 10, Wis.

CIRCUIT-BREAKERS

General Electric Co., Schenectady 5, N. Y.

CLAMPS, "C", Toggle, Toolmakers'

Parallel—See Set-Up Equipment
Spacing Equipment

CLEANERS, Metal

Houghton & Co., E. F., 303 W. Lehigh Ave., Philadelphia 33, Pa.
Oakite Products, Inc., 19 Rector St., New York, N. Y.

CLUTCHES

Cleveland Punch & Shear Works Co., 3917 St. Clair Ave., Cleveland 14, Ohio
Minster Mch. Co., Minster, Ohio
Rockford Clutch Div., Rockford, Ill.
Twin Disc Clutch Co., 1361 Racine St., Racine, Wis.

COLLETS—See Chucks, Collet

COMBINATION SQUARES—See Machinists' Small Tools

COMPARATORS, Dial, Electronic and Air

DoAll Co., Des Plaines, Ill.
Standard Gage Co., Inc., Poughkeepsie, N. Y.
Starrett, L. S. Co., Athol, Mass.

COMPARATORS, Optical

DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Eastman Kodak Co., Rochester, N. Y.
Jones & Lamson Mch. Co., Springfield, Vt.
Opto-Metric Tools, Inc., 137 Varick St., New York, N. Y.
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.

COMPOUNDS, Cleaning—See Cleaners, Metal

COMPOUNDS, Cutting, Grinding, Metal Drawing, etc.—See Cutting and Grinding Fluids

COMPOUNDS, Resin and Molding

Bakelite Co., Div. of Union Carbide & Carbon Corp., 30 E. 42nd St., N. Y., N. Y.

COMPRESSORS, Air

Chicago Pneumatic Tool Co., New York 17, N. Y.
Ingersoll-Rand Co., 11 Broadway, New York 4, N. Y.
Wilson, K. R., Inc., Arcade, N. Y.

CONTOUR FOLLOWER—See Tracing Attachments

CONTRACT WORK

Baker Brothers, Inc., 1000 Post St., Toledo 10, Ohio
 Bliss, E. W. Co., 1375 Raff Rd. S. W., Canton, Ohio
 Cleveland Automatic Machine Co., 4932 Beech St., Cincinnati 12, Ohio
 Eisler Engrg. Co., 750 S. 13th St., Newark 3, N. J.
 Erie Foundry Co., Erie, Pa.
 Kearney & Trecker Corp., Milwaukee 14, Wis.
 Lake Erie Engrg. Corp., 470 Woodward Ave., Buffalo 17, N. Y.
 Michigan Drill Head Co., Van Dyke, Mich.
 National Acme Co., 170 E. 131st St., Cleveland, Ohio
 Van Keuren Co., Watertown, Mass.
 Waltham Mch. Wks., Inc., Waltham, Mass.

CONTROLLERS

Allen-Bradley Co., 1331 S. 1st St., Milwaukee, Wis.
 Doelcam Div., Minneapolis-Honeywell, 1400 Soldier Field Rd., Boston 25, Mass.
 General Electric Co., Schenectady, N. Y.

CONVEYORS FOR DUST, CHIPS, ETC.

Barnes, W. F. & John Co., Rockford, Ill.
 Indiana Commercial Filters Corp., 28 South Ave., Lebanon, Ind.

COPPER

American Brass Co., 25 Broadway, New York, N. Y.
 Mueller Brass Co., Port Huron 35, Mich.
 Revere Copper & Brass Inc., 230 Park Ave., New York, N. Y.

COUNTERBORES AND COUNTERSINKS

Besly-Welles Corp., 112 Dearborn Ave., Beloit, Wis.
 Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.
 Circular Tool Co., Inc., 765 Allens Ave., Providence 5, R. I.
 Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio
 DoAll Co., Des Plaines, Ill.
 Eclipse Counterbore Co., 1600 Bonner Ave., Detroit 20, Mich.
 Ex-Cell-O Corp., 120 Oakman Blvd., Detroit 32, Mich.
 Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York
 Heller Tool Co., Newcomerstown, Ohio
 National Twist Drill & Tool Co., Rochester, Mich.
 Scully-Jones & Co., 1906 Rockwell St., Chicago 8, Ill.
 Star Cutter Co., 34500 Grand River, Farmington, Mich.
 Threadwell Tap & Die Co., 16 Arch St., Greenfield, Mass.
 Wesson Co., 1220 Woodward Heights Blvd., Detroit 20, Mich.
 Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mass.

COUNTERS

Brown & Sharpe Mfg. Co., Providence, R. I.
 Starrett, The L. S., Co., Athol, Mass.

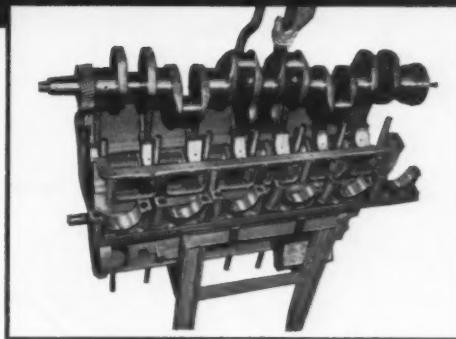
COUPLINGS

Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa.
 Boston Gear Works, 14 Hayward St., Quincy 71, Mass.
 Farrell-Birmingham Co., Inc., Ansonia, Conn.
 Mueller Brass Co., Port Huron, Mich.
 Philadelphia Gear Works, Erie Ave., and G St., Philadelphia, Pa.
 Schrader's Sons, A., 470 Vanderbilt Ave., Brooklyn 38, N. Y.
 Standard Pressed Steel Co., Jenkintown, Pa. (Shaft)
 Thor Power Tool Co., 175 N. State St., Aurora, Ill.
 Twin Disc Clutch Co., Racine, Wis.
 Walker Co., Inc., O. S., Rockdale St., Worcester, Mass.

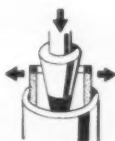
(Continued on page 338)

HOW MICROHONING generates round, accurate, aligned bearing bores

All types of cylindrical surfaces, including small diameters and combinations of soft and hard metals . . . interrupted by keyways, undercuts, ports, reliefs or cross holes . . . can be economically Microhoned to precision tolerances and alignment.



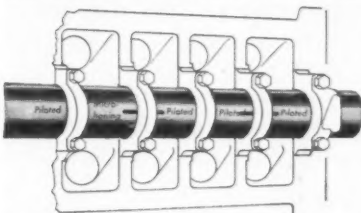
A typical example of Microhoning interrupted cylindrical surfaces is the Cummins Diesel Engine application. Here's how Microhoning generates accuracy and alignment in the crankshaft main bearing bores:



1. Cutting pressure is applied radially from the center of the Microhoning tool body. Abrasives and guides both are expanded by the same feed force, and wear at the same rate.

2. Abrading action is divorced from the effects of spindle or driveshaft vibration and misalignment by a universal joint that is between tool body and driveshaft.

3. The single bank of abrasives travels through all bores on every stroke. As abrasives are Microhoning one bore, the tool is piloted by the plastic guides in the other bores.



The principles and applications of Microhoning are thoroughly explained in a 16mm, 30-minute sound movie, "Progress in Precision". We'll be glad to reserve a print for your use.



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☐ Please send Microhoning literature; I am interested in the following application _____

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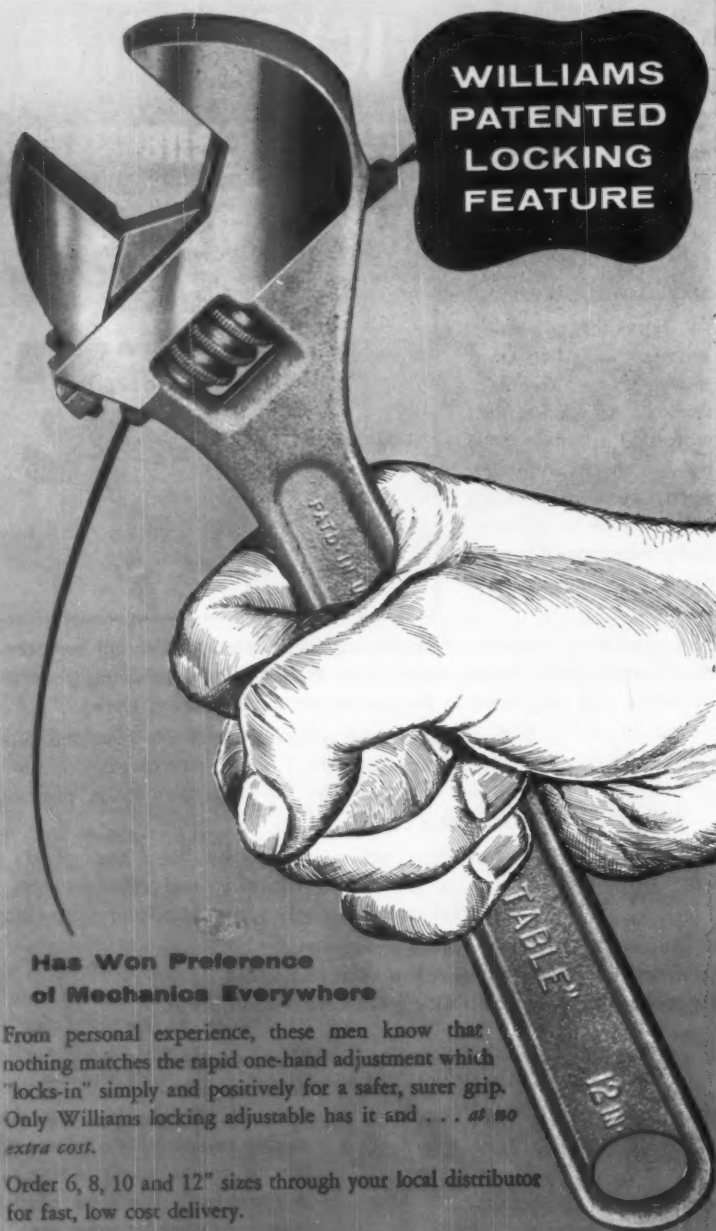
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Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.

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DoAll Co., Des Plaines, Ill.
Eclipse Counterbore Co., 1600 Bonner Ave., Detroit 20, Mich.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
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Kearney & Trecker Corp., Milwaukee, Wis.
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McCroskey Tool Corp., Meadville, Pa.
Metallurgical Products Dept. of General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
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National Twist Drill & Tl. Co., Rochester, Mich.
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Houghton, E. F. & Co., 303 W. Lehigh Ave., Philadelphia, Pa.
Match & Merryweather Mchry Co., Penton Bldg., Cleveland 3, Ohio
Oakite Products, Inc., 26 Rector St., New York 6, N. Y.
Shell Oil Co., 50 W. 50th St., New York, N. Y.
Sinclair Refining Co., 600 Fifth Ave., New York, N. Y.
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Cone Automatic Mch. Co., Windsor, Vt.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Griener Industries, Inc., Bowling Green, Ohio
Modern Machine Tool Co., Jackson, Mich.

CUTTING-OFF SAWS, Abrasive Wheel

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(Continued on page 340)

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- 3** The Ceco-Drop has created new standards of performance, and established new standards of tolerance in drop forgings.
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- 7** The Ceco-Drop forges more minutes per hour. (Once it is set-up, just turn on the air or steam and forge.) It does more forging per blow, requires no board changes, no friction adjustment.
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U. S. PATENT NO. 2,604,071, JULY, 1952 . . . OTHERS PENDING
CECO-DROPS HAVE BEEN BUILT IN SIZES FROM 500 LBS. TO 8000 LBS.



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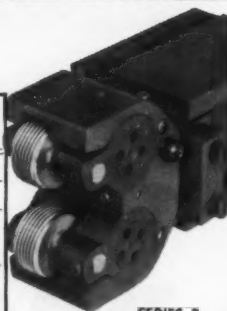
- $\frac{5}{16}$ " - 2" Straight Thread Diameters
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- 16 Thread Rolling Attachments
- 4 Different Types of Automatic Screw Machines
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are made in
FOUR STANDARD SIZES

Model No.	Complete Diameter Range	*Pipe Threads That May Be Rolled	Approximate Number of Common Screw Threads That May Be Rolled
B 10	0 - $\frac{5}{8}$ "	7	80
B 13	$\frac{1}{8}$ " - $\frac{13}{16}$ "	9	90
B 18	$\frac{1}{4}$ " - $1\frac{1}{8}$ "	15	105
B 36	$\frac{3}{8}$ " - $2\frac{1}{4}$ "	18	185

*Straight and Taper Pipe Threads, including Dryseal (NPTF). Change may be made from Straight to Taper Threading by changing rolls only. No other equipment is necessary.

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Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
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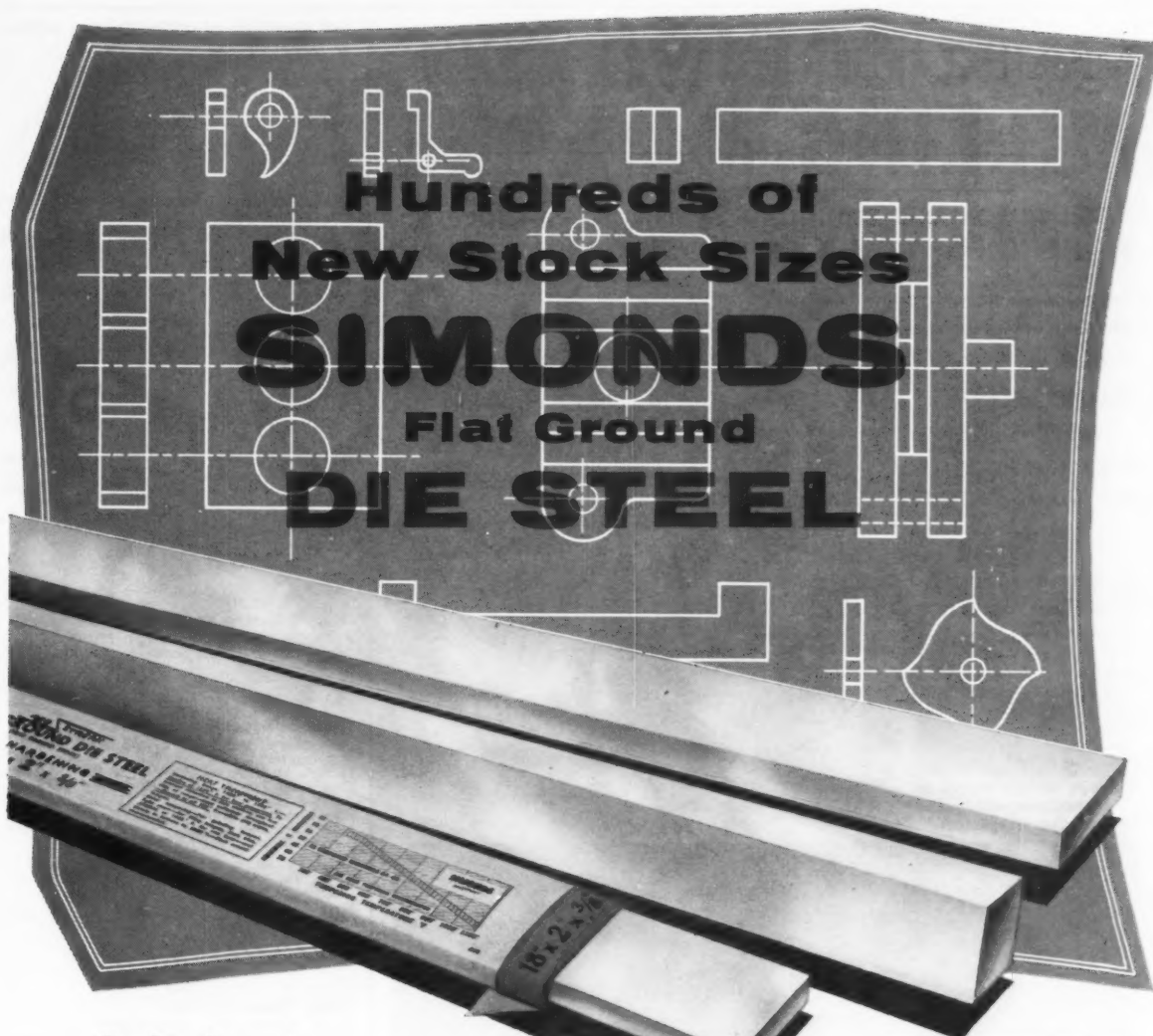
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(Continued on page 342)



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MACHINERY, November, 1956—341

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WITH AUTOMATIC SPINDLE POSITIONING CONTROLLED BY HAND POSITIONER OR PUNCHED CARD SYSTEM

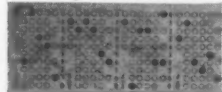
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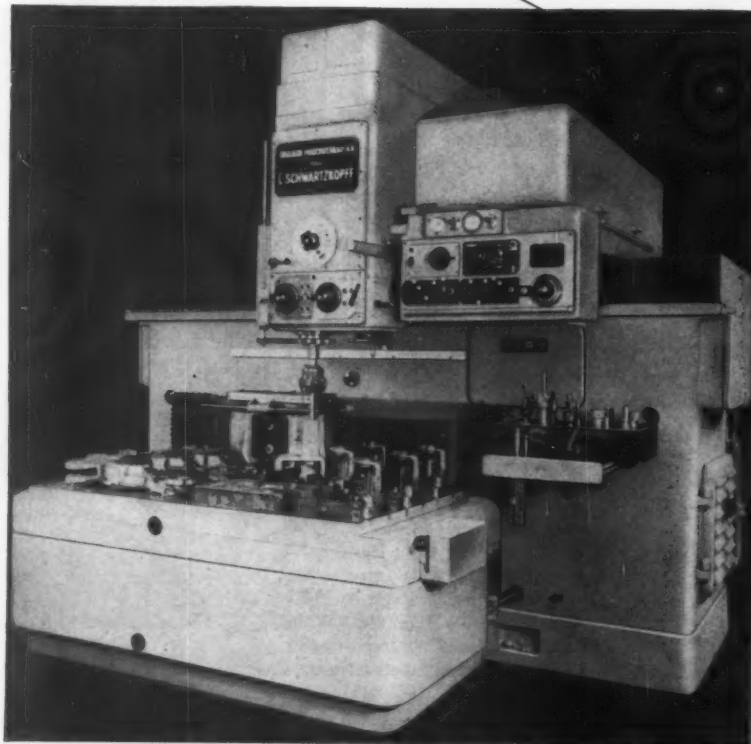
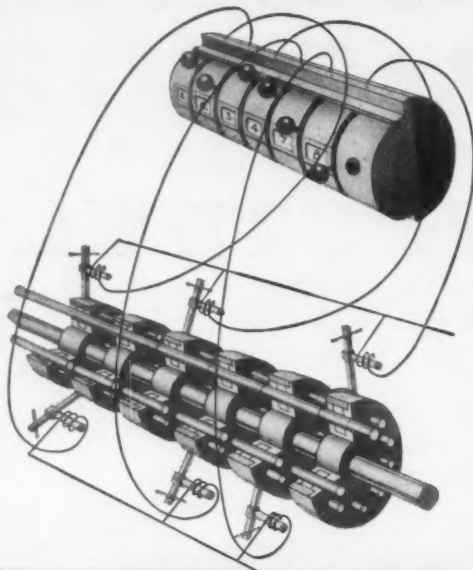
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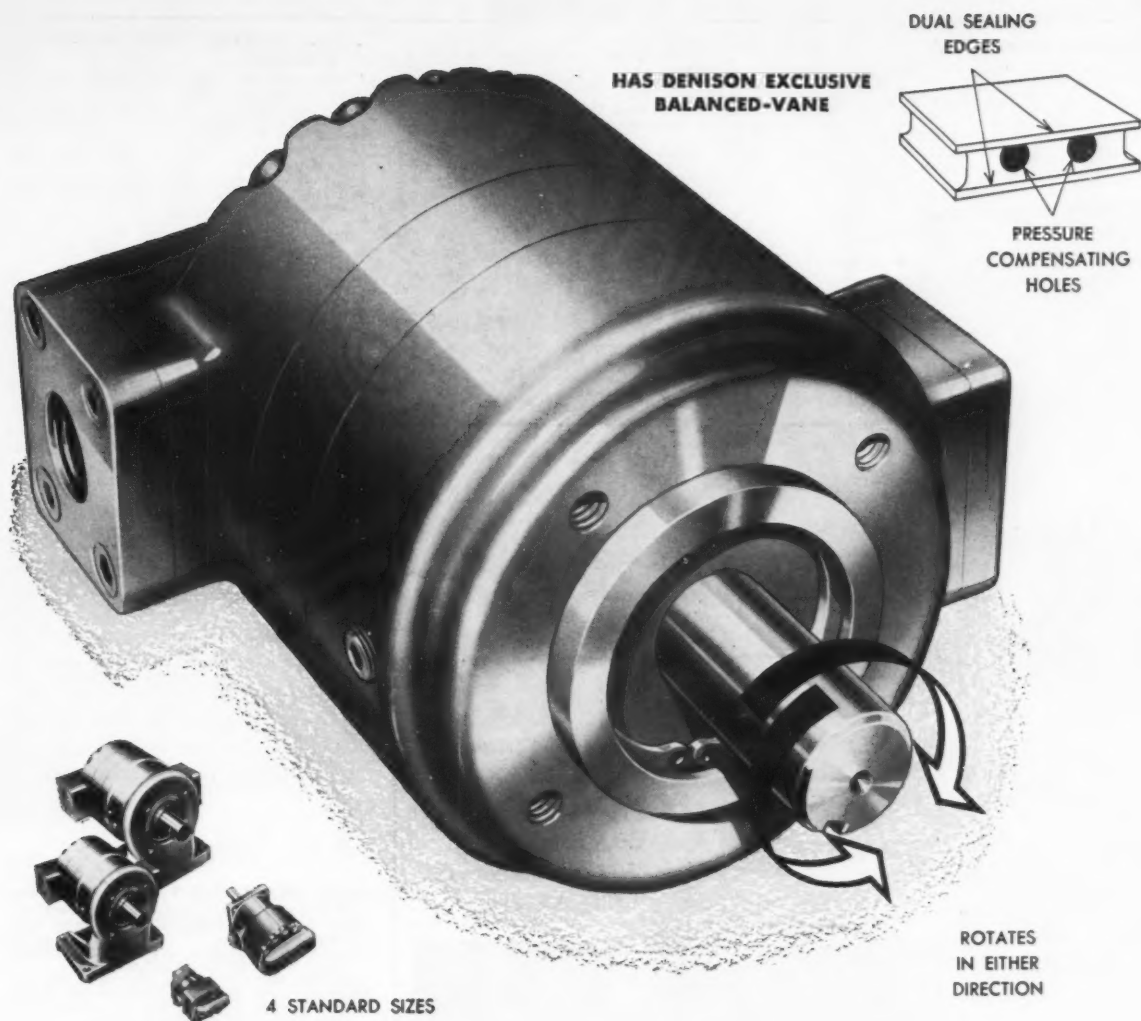
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(Continued on page 344)



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IT'S A MOTOR—high stalled torque up to 257 pound-inches per 100 psi. Takes high shock pressures without danger.

EXCLUSIVE—Denison *Radially Balanced Vane*; *Cuts wear* between cam ring and vane; *Increases efficiency* with dual sealing edges; *Reduces pulsation* by radial pumping action of vanes.

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MACHINERY, November, 1956—343

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Stuart Oil Co., Ltd., D. A., 2727 So. Troy St., Chicago 23, Ill.

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DoALL Co., 254 N. Laurel Ave., Des Plaines, Ill.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Hamilton Tool Co., 834 S. 9th St., Hamilton, Ohio.
Metal Carbides Corp., Youngstown, Ohio.

Metallurgical Products Dept. of General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Moore Special Tool Co., Inc., 724 Union Ave., Bridgeport, Conn.
Norton Co., 1 New Bond St., Worcester, Mass.
Pratt & Whitney Co., Inc., West Hartford, Conn.
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Kearney & Trecker Corp., Milwaukee 14, Wis.
LaSalle Tool, Inc., 3840 E. Outer Dr., Detroit 34, Mich.
Leland Gifford Co., Box 989, Worcester 1, Mass.
Michigan Drill Head Co., Van Dyke, Mich.
National Automatic Tool Co., Richmond, Ind.
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Thriftmaster Products Corp., 1076 N. Plum St., Lancaster, Pa.
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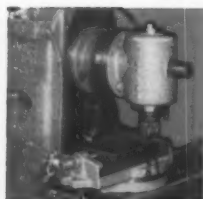
DRILL HEADS, Unit Type

Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Delta Power Tool Div., Rockwell Mfg. Co., Pittsburgh, Pa.
Hartford Special Machinery Co., 287 Homestead Ave., Hartford 12, Conn.
Kingsbury Mch. Tool Corp., Keene, N. H.
Michigan Drill Head Co., Detroit 34, Mich.
Milliholland, W. K. Machinery Co., 6402 Westfield Blvd., Indianapolis 5, Ind.
Morris Machine Tool Co., Inc., 946-H Harriet St., Cincinnati 3, Ohio.
Rehnberg-Jacobson Mfg. Co., 2135 Kiswaukee St., Rockford, Ill.
Snow Manufacturing Co., Bellwood, Illinois

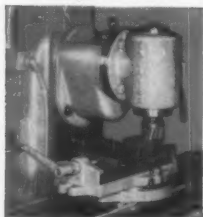
DRILLING AND BORING UNITS, Self-contained

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Barnes, W. F. & John Co., Rockford, Ill.
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(Continued on page 346)



Heavy Duty Vertical Milling Attachment



Heavy Duty Offset Vertical Milling Attachment



Universal Milling Attachment

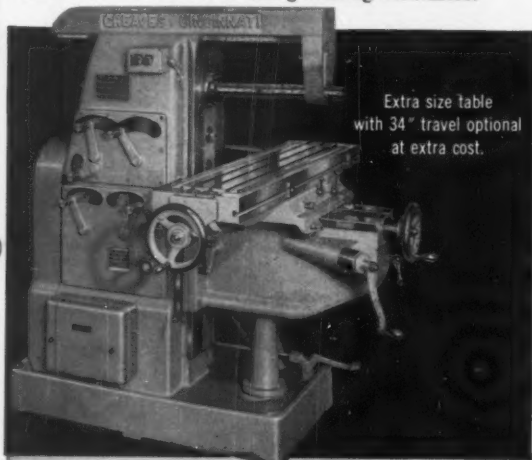


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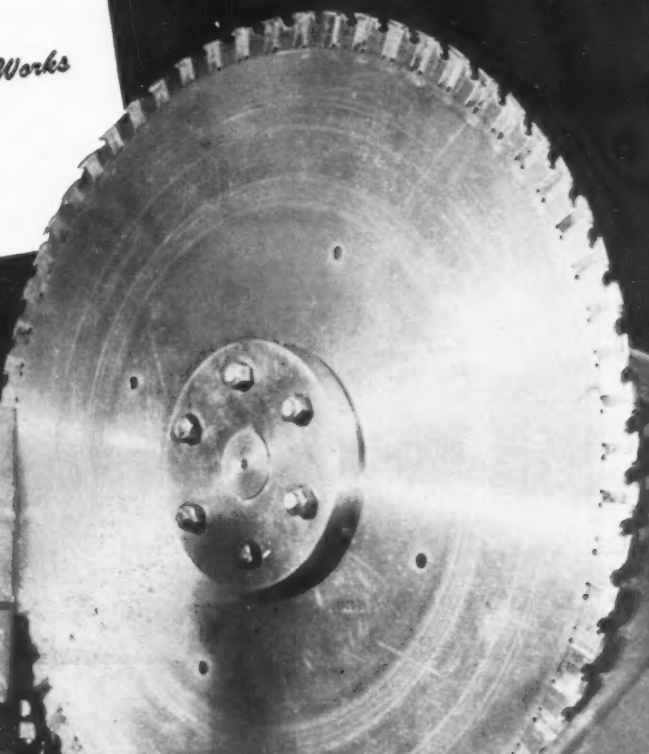
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DRILLING MACHINES, Automatic

Avey Drilling Machine Co., 25 East Third St.,
Covington, Ky.
Baker Brothers, Inc., 1000 Post St., Toledo
10, Ohio
Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Barnes, W. F. & John Co., Rockford, Ill.
Baush Machine Tool Co., 15 Wason Ave.,
Springfield, Mass.
Bodine Corp., 317 Mt. Grove St., Bridgeport
5, Conn.
Cosa Corp., 405 Lexington Ave., New York
17, N. Y.
Crass Co., 3250 Bellevue, Detroit 7, Mich.
Davis & Thompson Co., 4460 N. 124th St.,
Milwaukee 10, Wis.
Edlund Mchry. Co. Div., Cortland, N. Y.
Ettco Tool Co., Inc., 594 Johnson Ave., Brook-
lyn 37, N. Y.
Kearney & Trecker Corp., Milwaukee 14, Wis.
Kingsbury Mch. Tool Corp., Keene, N. H.
LaSalle Tool, Inc., 3840 E. Outer Dr., Detroit
34, Mich.
Leland-Gifford Co., Box 989, Worcester 1,
Mass.

Michigan Drill Head Co., Van Dyke, Mich.
Milholland, W. K. Machinery Co., 6402 West-
field Blvd., Indianapolis 5, Ind.
Modern Industrial Eng. Co., 14230 Birwood
Ave., Detroit 38, Mich.
Moline Tool Co., Moline, Ill.
Morris Machine Tool Co., 946-M Harriet St.,
Cincinnati 3, Ohio
National Automatic Tool Co., Inc., S. 7th and
N. Sts., Richmond, Ind.
Olofsson Corp., Lansing, Mich.
Russell, Holbrook & Henderson, Inc., 292 Mad-
ison Ave., New York 17, N. Y.
Snow Manufacturing Co., Bellwood, Ill.
Townsend, H. P., Mfg. Co., Elmwood, Conn.
Wales-Strippit Corp., North Tonawanda, N. Y.
Zagar, Inc., 24000 Lakeland Blvd., Cleveland
23, Ohio

DRILLING MACHINES, Bench

Atlas Press Co., 20108 N. Pitcher, Kalamazoo,
Mich.
Avey Drilling Machine Co., 25 East Third St.,
Covington, Ky.
Buffalo Forge Co., 490 Broadway, Buffalo,
N. Y.
Cincinnati Lathe & Tool Co., Marburg Ave.,
Cincinnati 9, Ohio

Cosa Corp., 405 Lexington Ave., New York
17, N. Y.
Delta Power Tool Div., 400 N. Lexington Ave.,
Pittsburgh, Pa.
Edlund Machinery Co. Div., Cortland, N. Y.
Fosdick Mch. Tool Co., 1638 Blue Rock, Cin-
cincinnati 23, Ohio
Hamilton Tool Co., 834 S. 9th St., Hamilton,
Ohio
Leland-Gifford Co., Box 989, Worcester, Mass.
South Bend Lathe Works, Inc., 425 E. Mad-
ison St., South Bend, Ind.

DRILLING MACHINES, Deep Hole

Avey Drilling Machine Co., 25 East Third St.,
Covington, Ky.
Baker Brothers, Inc., 1000 Post St., Toledo
10, Ohio
Baush Machine Tool Co., 15 Wason Ave.,
Springfield, Mass.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit
32, Mich.
Krueger-Barnes Corp., 1469 E. Grand Blvd.,
Detroit 11, Mich.
Leland-Gifford Co., Box 989, Worcester 1,
Mass.
Michigan Drill Head Co., Van Dyke, Mich.
Morris Mch. Tool Co., 946-M Harriet St., Cin-
cincinnati 3, Ohio
National Automatic Tool Co., Inc., S. 7th and
N. St., Richmond, Ind.
Pratt & Whitney Co., Inc., West Hartford,
Conn.
Wales-Strippit Corp., North Tonawanda, N. Y.

DRILLING MACHINES, Gang, Multiple- spindle

Avey Drilling Machine Co., 25 East Third St.,
Covington, Ky.
Baker Brothers, Inc., 1000 Post St., Toledo
10, Ohio
Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Barnes, W. F. & John Co., Rockford, Ill.
Baush Machine Tool Co., 15 Wason Ave.,
Springfield, Mass.
Bodine Corp., 317 Mt. Grove St., Bridgeport
5, Conn.
Cincinnati Bickford Div., Oakley, Cincinnati,
Ohio
Consolidated Mch. Tool Corp., Rochester, N. Y.
Davis & Thompson Co., 4460 124th St., Mil-
waukee 10, Wis.
Delta Power Tool Div., 400 N. Lexington Ave.,
Pittsburgh, Pa.
Edlund Machinery Co. Div., Cortland, N. Y.
Foote-Burt Co., 1300 St. Clair Ave., Cleveland,
Ohio
Fosdick Mch. Tool Co., 1638 Blue Rock, Cin-
cincinnati 23, Ohio
Greenlee Bros. & Co., 2136 12th St., Rock-
ford, Ill.
Hamilton Tool Co., 834 So. 9th St., Hamil-
ton, Ohio
Ingersoll Milling Mch. Co., 2442 Douglas St.,
Rockford, Ill.
Leland-Gifford Co., Box 989, Worcester, Mass.
Michigan Drill Head Co., Van Dyke, Mich.
Modern Industrial Eng. Co., 14230 Birwood
Ave., Detroit 38, Mich.
Moline Tool Co., Moline, Ill.
Morris Machine Tool Co., Inc., 946-M Harriet
St., Cincinnati 3, Ohio
National Automatic Tool Co., Inc., S. 7th and
N. St., Richmond, Ind.
Snyder Tool & Engrg. Co., 3400 E. Lafayette,
Detroit 7, Mich.
South Bend Lathe Works, South Bend 22, Ind.

DRILLING MACHINES, Radial

American Tool Works Co., Pearl and Eggleston
Ave., Cincinnati, Ohio
Carlton Mch. Tool Co., 2961 Meeker St., Cin-
cincinnati 25, Ohio
Cincinnati Bickford Div., Oakley, Cincinnati,
Ohio
Cincinnati Gilbert Machine Tool Co., 3366
Beekman St., Cincinnati 23, Ohio
Cincinnati Lathe & Tool Co., Marburg Ave.,
Cincinnati 9, Ohio
Cleveland Punch & Shear Works Co., 3917 St.
Clair Ave., Cleveland 14, Ohio
Cosa Corp., 405 Lexington Ave., New York
17, N. Y.
Foote-Burt Co., 1300 St. Clair Ave., Cleve-
land, Ohio
Fosdick Mch. Tool Co., 1638 Blue Rock, Cin-
cincinnati 23, Ohio

(Continued on page 348)

For control of cutting costs

... use **CIRCOLOY** Saws

Circoloy Saws do jobs too tough for
HSS, not tough enough for carbide — en-
abling you to cut costs by restricting use of
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R, widely outperforms HSS in terms of longer
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Circoloy assures the
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indispensable to automation.

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Dayton	Milwaukee	Phoenix	St. Louis
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SAWS • SOLID & TIPPED
TUNGSTEN CARBIDE SAWS
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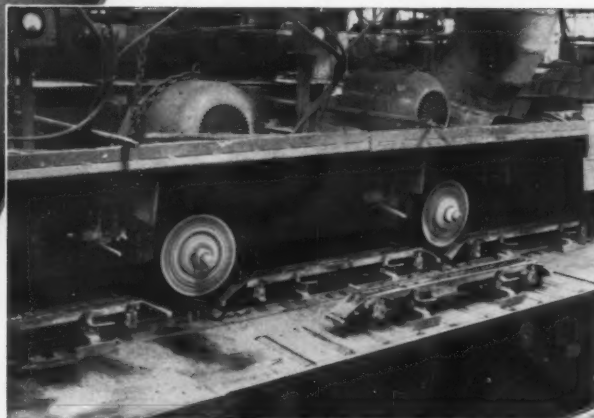
CIRCUAR TOOL CO., INC.

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Specialists in Circular Cutting Tools Since 1923

BEFORE
BRUSHING

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BRUSHING
(prior to plating)



A leading manufacturer uses 16" diameter Osborn Fascut® Brushes, operating at 1700 rpm, to finish automotive trim parts prior to plating.

Smooth start for a perfect finish


THE bright smoothness of metallic trim—adding a final touch of beauty to thousands of products—must start with an equally smooth surface prior to plating.

Makers and users of trim parts find Osborn power brushing methods ideal for removing draw marks, blending imperfections into an unmarred plating surface, materially reducing rejects.

An **Osborn Brushing Analysis**, made in your plant and at no obligation, will point out the many ways Osborn power brushing can improve your metal finishing operations. Write *The Osborn Manufacturing Company, Dept. 47, 5401 Hamilton Avenue, Cleveland 14, Ohio.*



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High Speed

Reamers

extra with cutting mileage built in

Chicago-Latrobe High Speed Reamers are made as if they were intended to last forever . . . and they almost do. So next time order Chicago-Latrobe from your distributor . . . accept no substitutes. The extra life will save you money; the complete line assures service.



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Russell, Holbrook & Henderson, Inc., 292 Madison Ave., New York 17, N. Y.
Western Machine Tool Works, Holland, Mich.

DRILLING MACHINES, Sensitive

Atlas Press Co., 20108 N. Pitcher, Kalamazoo, Mich.
Avey Drilling Machine Co., 25 East Third St., Covington, Ky.
Baker Brothers, Inc., 1000 Post St., Toledo 10, Ohio
Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
Cincinnati Bickford Div., Oakley, Cincinnati, Ohio
Cincinnati Lathe & Tool Co., 3207-3211 Disney St., Cincinnati 9, Ohio
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Delta Power Tool Div., 400 N. Lexington Ave., Pittsburgh, Pa.
Edlund Machinery Co. Div., Cortland, N. Y.
Foote-Burt Co., 1300 St. Clair Ave., Cleveland 8, Ohio
Fosdick Mch. Tool Co., 1638 Blue Rock St., Cincinnati 23, Ohio
Hamilton Tool Co., 834 S. 9th St., Hamilton, Ohio
Leland-Gifford Co., Box 989, Worcester, Mass.
Levin & Son, Inc., Louis, 3610 So. Broadway, Los Angeles 7, Calif.
National Automatic Tool Co., Inc., S. 7th and N. Sts., Richmond, Ind.
Snow Manufacturing Co., Bellwood, Illinois
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Townsend, H. P., Mfg. Co., Elmwood, Conn.
Wales-Strippit Corp., North Tonawanda, N. Y.
Western Machine Tool Works, Holland, Mich.

DRILLING MACHINES, Upright

Avey Drilling Machine Co., 25 East Third St., Covington, Ky.
Baker Brothers, Inc., 1000 Post St., Toledo 10, Ohio
Barnes, W. F. & John Co., Rockford, Ill.
Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
Cincinnati Bickford Div., Oakley, Cincinnati, Ohio
Cincinnati Lathe & Tool Co., Marburg Ave., Cincinnati 9, Ohio
Cosa Corp., 405 Lexington Ave., New York, N. Y.
Ettco Tool Co., Inc., 594 Johnson Ave., Brooklyn 37, N. Y.
Fosdick Mch. Tool Co., 1638 Blue Rock, Cincinnati 23, Ohio
Homestrand, Inc., Larchmont, N. Y.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Michigan Drill Head Co., Van Dyke, Mich.
National Automatic Tool Co., Inc., S. 7th and N. Sts., Richmond, Ind.
Rehner-Jacobson Mfg. Co., 2135 Kishwaukee St., Rockford, Ill.
Snow Manufacturing Co., Bellwood, Ill.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Wales-Strippit Corp., North Tonawanda, N. Y.
Western Machine Tool Works, Holland, Mich.

DRILLS, Center

Besly-Welles Corp., 112 Dearborn Ave., Beloit, Wis.
Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.
Circular Tool Co., Inc., 765 Allens Ave., Providence 5, R. I.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio
DoALL Co., Des Plaines, Ill.
Greenfield Tap & Die Corp., Greenfield, Mass.
National Twist Drill & Tool Co., Rochester, Mich.
Threadwell Tap & Die Co., 16 Arch St., Greenfield, Mass.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

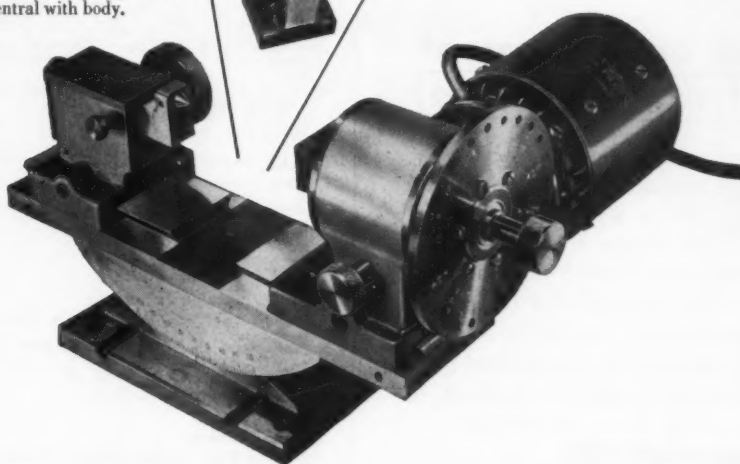
DRILLS, Core

Ace Drill Corp., Adrian, Mich.
Besly-Welles Corp., 112 Dearborn Ave., Beloit, Wis.
Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland 14, Ohio
DoALL Co., Des Plaines, Ill.

(Continued on page 350)

Save on small grinding jobs with Moore Motorized Centers

All ground in one set-up. These parts illustrate wide variety of Motorized Centers' work. Small punch in top row has a rectangular end $1/32" \times 3/32"$, ground central with body.



New toolroom attachment for surface grinders, jig borers, drill presses, millers, etc., handles flat, curved or circular work in one setting.

You'll wonder how you ever got along without this portable, precision-built grinding accessory. No longer is it necessary to tie up large, expensive machines to grind square and round punches...do taper grinding, index grinding and face-plate work.

• Motorized Centers can be set on a surface grinder chuck in a jiffy and the job completed quicker than the grinding wheel on a large machine can be changed. Think of the resulting savings in costly toolroom labor and materials.

With it, in one setting, you can now grind flat, curved or circular work—in any combination of taper or contour—all within .0005". The index plate allows indexing in the same operation, too. Tapers can be reversed or changed by loosening two screws in the rocking bed, and the index plate can be engaged by merely pressing a plunger. The simple

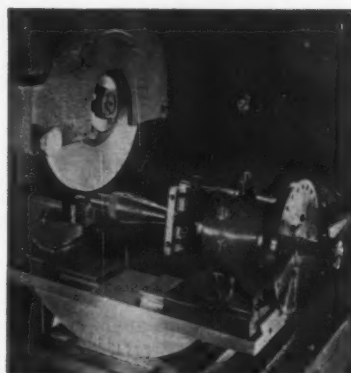
tail-stock center readily permits the use of specials—male, female or cutaway.

CATALOG WITH 20 ACTION PHOTOGRAPHS will show you graphically how you can use this versatile tool for production and inspection, too. In it are examples of some of the many difficult toolroom jobs you can handle easily: double tapers, equally spaced slots, small cylindrically tapered punches and many others. It's yours for the asking.

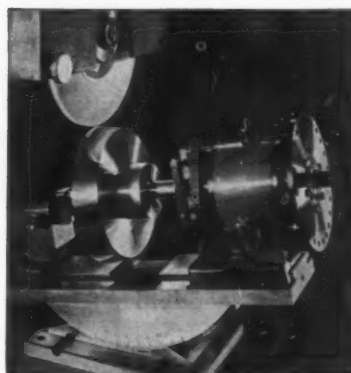
SPECIFICATIONS

Length—overall	12"
Width—including motor	10"
Height—overall	8"
Distance between centers—maximum	6"
Centers will swing	6"
Maximum grinding angle (using 10° angle block)	30°
Motor	1/25 H.P., 115 volt, 60 cycle
Work speeds	110-220-440 R.P.M.

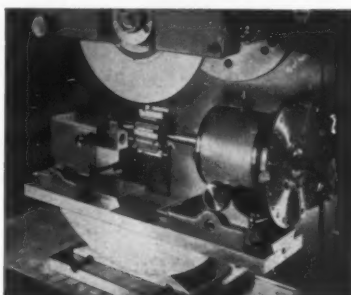
MOORE SPECIAL TOOL COMPANY, INC.
734 Union Avenue, Bridgeport 7, Conn.



Double tapers and hex shoulder ground with a single set-up. Rocking bed is equipped with a tangential screw for fine-setting taper angles.



Grinding a 10° taper on a machine part 5" long, 5" in diameter on centers.



12 equally spaced slots in punch holder ground by using index plate.

● Engineered specially to your work prints, McCrosky "Specials" combine related facing, boring, counter-boring and chamfering operations — perform them all simultaneously. This assures absolute concentricity and uniformity of finished pieces — eliminates stock-piling and re-handling between operations — speeds up production — reduces the amount of work in process — shortens deliveries — and produces other economies so great that they pay their way even on moderately short runs. Send your work prints to McCrosky, and write for a "Specials" bulletin. It gives complete details; illustrates nearly 50 typical examples.

McCROSKY TOOL CORPORATION
1353 Main Street
Meadville, Penna.

**COST
CUTTING
TOOLS**

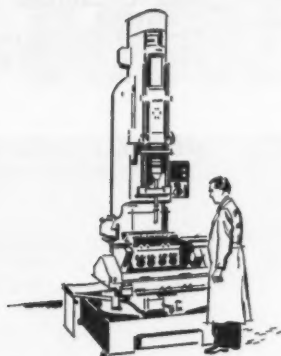
Please send Bulletins describing the tools checked below.

- ☐ *Jack-Lock*[®]
MILLING CUTTERS
 - ☐ *Block-Type*
BORING BARS
 - ☐ *Super*[®] Adjustable
REAMERS
 - ☐ *Turret*
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 - ☐ *Wizard*[®]
QUICK-CHANGE CHUCKS
 - ☐ *Specially Engineered*
MULTIPLE PRODUCTION TOOLS

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Besly-Welles Corp., 112 Dearborn Ave., Be-
loft, Wis.
Chicago-Latrobe Twist Drill Works, 411 W.
Ontario St., Chicago, Ill.
Cleveland Twist Drill Co., 1242 E. 49th St.,
Cleveland 14, Ohio

(Continued on page S52)



*"Today...
Rejection rate
is NIL!"*

A large Midwest pump manufacturing company had run up against an expensive finishing problem. They were using a super finisher with an abrasive stone to cut and polish 410 stainless steel shafting to a four micro finish. The hardness of the shafting was Rockwell B60-90. Although they tried a number of honing fluids recommended by various companies, the rejection of finished shafting was high and stone life was short. On a routine call, Sinclair Industrial Representative P. W. Stevens was asked for his recommendations.

Light-bodied coolant recommended...

Mr. Stevens reports, "Examination showed the need for a light-bodied coolant specifically designed for use as a honing fluid for both ferrous and some non-ferrous metals. From previous experience with a similar problem, I recommended Sinclair HONOL Medium."

Problem solved...

Mr. Stevens continues, "The company tried Sinclair HONOL Medium on a test basis. A follow-up showed they were getting exceedingly fine finish and accuracy, with sufficient carry-off of steel particles during the honing operation. The amount of heat generated was kept to a minimum, thus preventing distortion of parts. The company reports that today their rejection rate is nil. Moreover, all pieces have the desired four micro finish, and stone life has increased considerably. This manufacturer now specifies Sinclair HONOL Medium for his finishing operations, and uses the same product for honing brass."

Why not let a Sinclair Lubrication Engineer help solve *your* lubrication problem. *There's no obligation.* Contact your local Sinclair office or write Sinclair Refining Company, Technical Service Division, 600 Fifth Avenue, New York 20, N. Y.

SINCLAIR LUBRICANTS

DoALL Co., Des Plaines, Ill.
Greenfield Tap & Die Corp., Greenfield, Mass.
National Twist Drill & Tool Co., Rochester, Mich.
Thor Power Tool Co., 175 N. State St., Aurora, Ill.
Threadwell Tap & Die Co., 16 Arch, Greenfield, Mass.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

DRILLS, Twist, Carbide, Carbide-tipped
Ace Drill Corp., Adrian, Mich.
Allegheny Ludlum Steel Corp., Oliver Bldg., Pittsburgh 22, Pa.
Besly-Welles Corp., 112 Dearborn Ave., Beloit, Wis.
Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland 14, Ohio
DoALL Co., Des Plaines, Ill.
Heller Tool Co., Newcomerstown, Pa.
National Twist Drill & Tool Co., Rochester, Mich.

Thor Power Tool Co., 175 N. State St., Aurora, Ill.
Threadwell Tap & Die Co., 16 Arch St., Greenfield, Mass.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

DRILLS, Wire

Ace Drill Corp., Adrian, Michigan.
Besly-Welles Corp., 112 Dearborn Ave., Beloit, Wis.
Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.
Cleveland Twist Drill Co., Cleveland, Ohio.
Greenfield Tap & Die Corp., Greenfield, Mass.
National Twist Drill & Tool Co., Rochester, Mich.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

DUPLICATING ATTACHMENTS—See Tracing Attachments

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Brown & Sharpe Mfg. Co., Providence, R. I.
Pangborn Corp., Hagerstown, Md.
Standard Electrical Tool Co., 2500 River Rd., Cincinnati 14, Ohio

ELECTRICAL DISCHARGE MACHINES
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Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Gorton, Geo., Mach., 1321 Racine St., Racine, Wis.

EXTRACTORS, Screw

Chicago-Latrobe Twist Drill Wks., 411 W. Ontario St., Chicago 10, Ill.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio
Greenfield Tap & Die Corp., Greenfield, Mass.
Williams & Co., J. H., 400 Vulcan St., Buffalo 7, N. Y.

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Baker Brothers, Inc., 1000 Post St., Toledo 10, Ohio
Cross Co., 3250 Bellevue, Detroit 7, Mich.
Davis Boring Tool Div., Giddings & Lewis Mch. Tool Co., Fond du Lac, Wis.
Giddings & Lewis Mch. Tool Co., Fond du Lac, Wis.
Michigan Drill Head Co., Van Dyke, Mich.
Mummert-Dixon Co., Hanover, Pa.

FANS, Exhaust, Ventilating

Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.

FELT, For All Applications

American Felt Co., Glenville, Conn.

FILES, Band

DoALL Co., Des Plaines, Ill.

FILES, General-purpose, Swiss Pattern

DoALL Co., Des Plaines, Ill.
Heller Tool Co., Newcomerstown, Ohio
Simonds Saw & Steel Co., 470 Main St., Fitchburg, Mass.

FILES AND BURRS, Rotary

DoALL Co., Des Plaines, Ill.
Heller Tool Co., Newcomerstown, Ohio
Pratt & Whitney Co., Inc., West Hartford, Conn.
Simonds Saw & Steel Co., Fitchburg, Mass.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.

FILING MACHINES

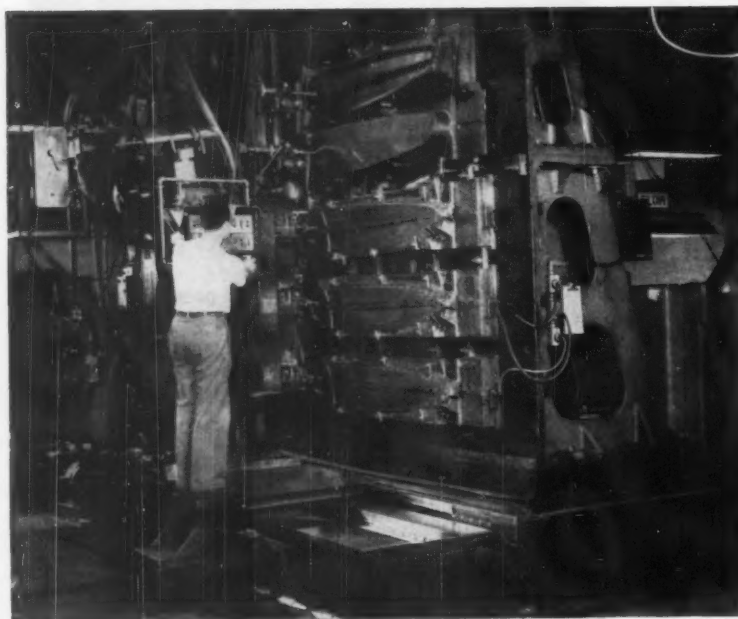
Chicago Pneumatic Tool Co., New York 17, N. Y.
DoALL Co., Des Plaines, Ill.
Oliver Instrument Co., 1410 E. Maumee St., Adrian, Mich.

FILTERS, Coolant and Oil

Barnes Drill Co., 814 Chestnut St., Rockford, Ill.
Cuno Engineering Corp., Lebanon, Ind.
DeLaval Separator Co., Poughkeepsie, N. Y.
Indiana Commercial Filters Corp., 28 South Ave., Lebanon, Ind.
Industrial Filtration Co., 15 Industrial Ave., Lebanon, Ind.
Marvel Engineering Co., 7227 N. Hamlin Ave., Chicago 45, Ill.

(Continued on page 354)

Walker Does it Again -



Three WALKER electro-magnetic chucks mounted on milling machine, making possible profile milling three propeller blades in one operation.

WALKER engineers and makes chucks for unusual applications as well as standard holding devices for irons and steels, non-ferrous metals and non-metallic materials.

Whatever your holding problem the originators of the magnetic chuck will solve it for you.

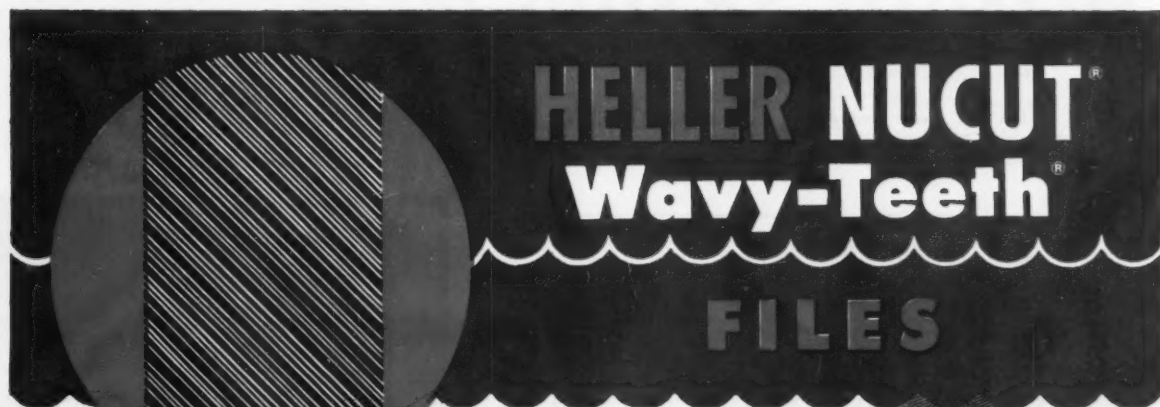
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WORCESTER 6, MASSACHUSETTS

Original Designers and Builders of Magnetic Chucks

IN CANADA—UPTON BRADEEN & JAMES, LTD.

get **DOUBLE ACTION** with...



OVERCUT

The "overcut" creates a pattern of coarse and fine teeth.

HELLER Nucut Wavy-Teeth design combines both coarse and fine teeth in the same file to give fast stock removal and leave a smooth finish.

The coarse teeth cut fast, take a good bite, while the fine teeth break up the chips and permit quick clearing from the file.

This **DOUBLE ACTION** makes it possible to file with less effort and remove more metal with fewer strokes. Loading is minimized, chatter reduced and a smoother finish produced.

This is why HELLER Wavy-Teeth files are easier to use, last longer, cut filing costs. It will pay you to ask for HELLER NUCUT WAVY-TEETH next time you order files!



UPCUT and OVERCUT FINISHED FILE

When the "upcut" is added the "Wavy-Teeth" design is created with larger cutting teeth and smaller clearing teeth.

HELLER TOOL CO.

Subsidiary of Simonds Saw and Steel Co.



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BRANCHES: New York, Detroit, Chicago, Los Angeles

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Other Famous HELLER FILES:
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YOUR HELLER DISTRIBUTOR CAN SUPPLY ALL YOUR FILE NEEDS

FINISHES, Machine and Metal

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Cincinnati Milling and Grinding Mchs., Inc.,
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Gleason Works, 1000 University Ave., Roch-
ester 3, N. Y.

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Chambersburg Engrg. Co., Chambersburg, Pa.
Erie Foundry Co., Erie, Pa.

FORGING, Machines, Headers, Upsetters

Ajax Mfg. Co., Euclid, Cleveland 17, Ohio
Bliss, E. W. Co., 1375 Raff Rd., S. W., Can-
ton, Ohio
Hill Acme Co., 1201 W. 65th St., Cleveland
2, Ohio

FORGINGS, Drop

Bethlehem Steel Co., 701 East Third St., Beth-
lehem, Pa.
Crucible Steel Co. of America, Henry W. Oli-
ver Bldg., Mellon Square, Pittsburgh 22, Pa.
Mueller Brass Co., Port Huron 35, Mich.
Williams, J. H. & Co., 400 Vulcan St., Buf-
falo 7, N. Y.

FORGINGS, Hollow-Bored

Bethlehem Steel Co., 701 East Third St., Beth-
lehem, Pa.
Mueller Brass Co., Port Huron, Mich.
National Forge & Ordnance Co., Irvine, War-
ren County, Pa.

FORGINGS, Press

Bethlehem Steel Co., 701 East Third St., Beth-
lehem, Pa.
Bridgeport Brass Co., Bridgeport, Conn.
Cleveland Punch & Shear Works Co., 3917 St.
Clair Ave., Cleveland 14, Ohio
Farquhar Div., A. B., 142 N. Duke St., York,
Pa.
Minster Mch. Co., Minster, Ohio
Mueller Brass Co., Port Huron, Mich.
National Forge & Ordnance Co., Irvine, War-
ren County, Pa.
Revere Copper & Brass, Inc., 230 Park Ave.,
New York 17, N. Y. (die-pressed)
U. S. Steel Corp., Pittsburgh, Pa.

FORGINGS, Upset

Bethlehem Steel Co., 701 East Third St., Beth-
lehem, Pa.
New Departure Div., Bristol, Conn.
Vanadium-Alloys Steel Co., Latrobe, Pa.
Williams, J. H. & Co., 400 Vulcan St., Buf-
falo 7, N. Y.

FORMING MACHINES, Cold-rolling

Cincinnati Milling Machine Co., Process Ma-
chinery Div., Cincinnati 9, Ohio
Ferracute Machine Co., Bridgeton, N. J.
Hannifin Corp., 501 S. Wolf Rd., Des Plaines,
Ill.
Hydraulic Press Mfg. Co., Mount Gilead, Ohio
Lake Erie Eng. Corp., 470 Woodward Ave.,
Buffalo, N. Y.
Michigan Tool Co., 7171 E. McNichols Rd.,
Detroit 12, Mich.
Niagara Mch. & Tool Works, 637 Northland
Ave., Buffalo, N. Y.
Yoder Co., 5500 Walworth, Cleveland, Ohio

FORMING MACHINES, Multiple-slide

Baird Machine Co., 1700 Stratford Ave., Strat-
ford, Conn.
Baldwin-Lima-Hamilton Corp., Lima-Hamilton
Div., Hamilton, Ohio
Bliss, E. W. Co., 1375 Raff Rd., S. W., Can-
ton, Ohio
Chambersburg Engrg. Co., Chambersburg, Pa.
Clearing Machine Corp., 6499 W. 65 St., Chi-
cago 38, Ill.
Cosa Corp., 405 Lexington Ave., New York
17, N. Y.
Dreis & Krump Mfg. Co., 7416 Loomis Blvd.,
Chicago 36, Ill.
U. S. Tool Co., Inc., 255 North 18th St., Am-
perre, N. J.

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Corp., 30 E. 42nd St., New York
Kennametal, Inc., Latrobe, Pa.
National Broach & Mch. Co., 5600 St. Jean
Ave., Detroit 2, Mich.
Wesson Co., 1220 Woodward Heights Blvd.,
Ferndale, Mich.

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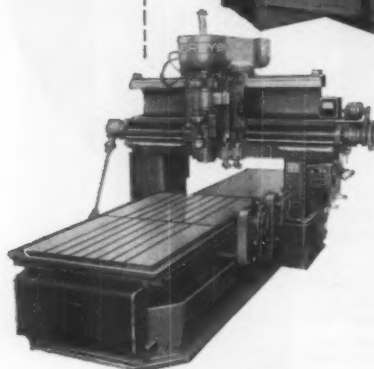
GAGE BLOCKS

Brown & Sharpe Mfg. Co., Providence, R. I.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
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(Continued on page 356)

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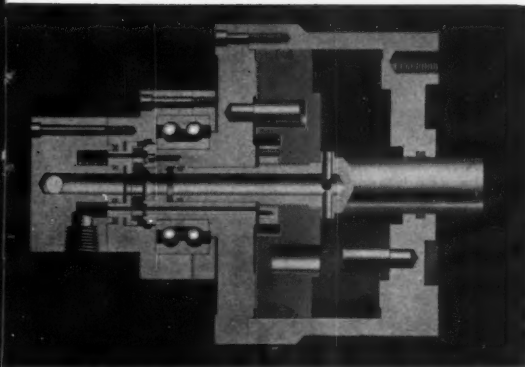
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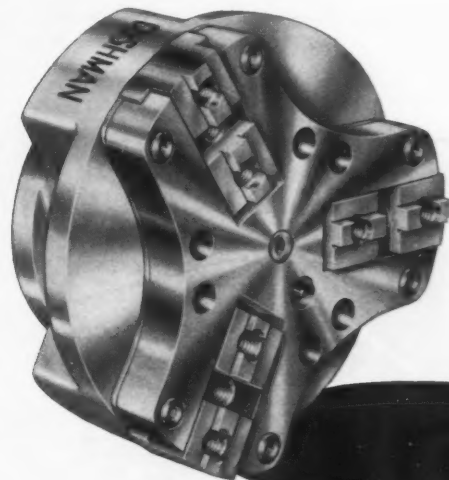
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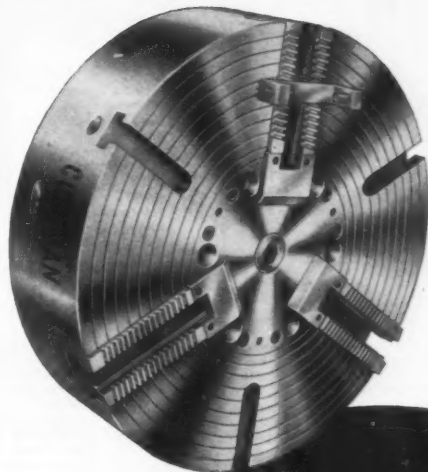


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 Sheffield Corp., Box 893, Dayton 1, Ohio

GAGES, Automatic Sorting

Federal Products Corp., 1144 Eddy St., Providence 1, R. I.

GAGES, Dial, Bore, Height, Depth, Thread, Groove, etc.

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 Bryant Chucking Grinder Co., Clinton St., Springfield, Vt.

Comtor Co., 47 Farwell St. Waltham 54 Mass.
 DoALL Co., Des Plaines, Ill.
 Federal Products Corp., 1144 Eddy St., Providence 1, R. I.
 Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.
 Standard Gage Co., Inc., Poughkeepsie, N. Y.
 Starrett, The L. S., Co., Athol, Mass.

GAGES, Electric Comparator

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 DoALL Co., Des Plaines, Ill.
 Federal Products Corp., 1144 Eddy St., Providence 1, R. I.
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 Sheffield Corp., Box 893, Dayton 1, Ohio

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Brown & Sharpe Mfg. Co., Providence, R. I.

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 Pratt & Whitney Co., Inc., West Hartford, Conn.
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 Brown & Sharpe Mfg. Co., Providence, R. I.
 DoALL Co., Des Plaines, Ill.
 Greenfield Tap & Die Corp., Greenfield, Mass.
 Metallurgical Products Dept. of General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
 Pratt & Whitney Co., Inc., West Hartford, Conn.
 Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.
 Sheffield Corp., Box 893, Dayton 1, Ohio
 Standard Gage Co., Inc., Poughkeepsie, N. Y.
 Threadwell Tap & Die Co., 16 Arch St., Greenfield, Mass.
 Van Keuren Co., Watertown, Mass.
 Winter Bros. Co., Rochester, Mich.

GAGES, Pressure, Air and Hydraulic

Modern Industrial Eng. Co., 14230 Birwood Ave., Detroit 38, Mich.

GAGES, Roll Thread Snap, Adjustable Snap

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 Greenfield Tap & Die Corp., Greenfield, Mass.
 Sheffield Corp., Box 893, Dayton 1, Ohio
 Standard Gage Co., Inc., Poughkeepsie, N. Y.
 Threadwell Tap & Die Co., 16 Arch St., Greenfield, Mass.

GAGES, Surface Roughness

DoALL Co., Des Plaines, Ill.
 Sheffield Corp., Box 893, Dayton 1, Ohio

GAGES, Vernier, Height, Depth, Gear Tooth

Brown & Sharpe Mfg. Co., Providence, R. I.
 DoALL Co., Des Plaines, Ill.
 Federal Products Corp., 1144 Eddy St., Providence 1, R. I.
 Starrett Co., L. S., Athol, Mass.

GASKETS

Garlock Packing Co., Palmyra, N. Y.
 Houghton & Co., E. F., 303 W. Lehigh Ave., Philadelphia 33, Pa.

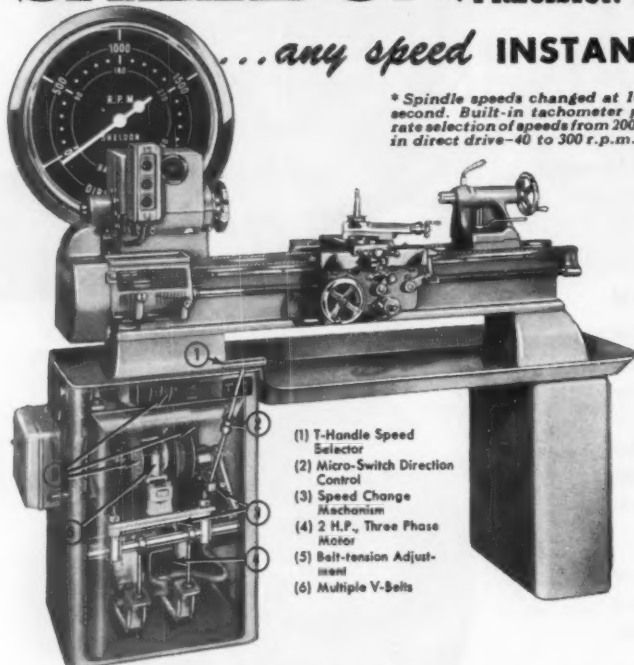
GEAR BURNISHERS

Fellows Gear Shaper Co., Springfield, Vt.
 Gleason Works, 1000 University Ave., Rochester 3, N. Y.
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(Continued on page 358)

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Variable Speed PRECISION LATHES



...any speed INSTANTLY*

* Spindle speeds changed at 100 r.p.m. per second. Built-in tachometer permits accurate selection of speeds from 200 to 1800 r.p.m. in direct drive—40 to 300 r.p.m. in back gear.

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- (4) 2 H.P., Three Phase Motor
- (5) Belt-tension Adjustment
- (6) Multiple V-Belts

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 Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
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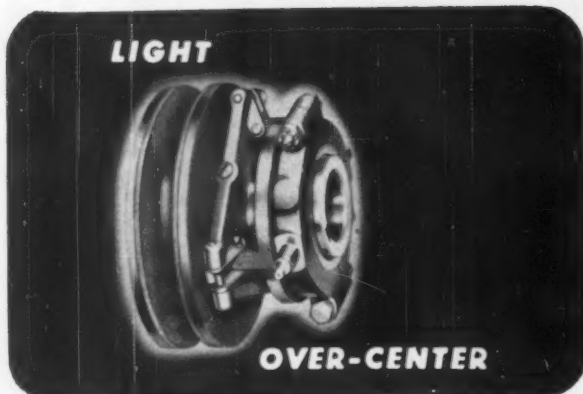
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 Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
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 Greaves Machine Tool Co., 2011 Eastern Ave., Cincinnati, Ohio
 Illinois Gear & Mch. Co., 2108 No. Natchez Ave., Chicago 35, Ill.
 New Jersey Gear & Mfg. Co., Hillside, N. J.
 Philadelphia Gear Works, Erie Ave. and G. St., Philadelphia, Pa.
 Ryerson, Jos. T. & Son, Inc., 16th and Rockwell St., Chicago 8, Ill.
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(Continued on page 360)

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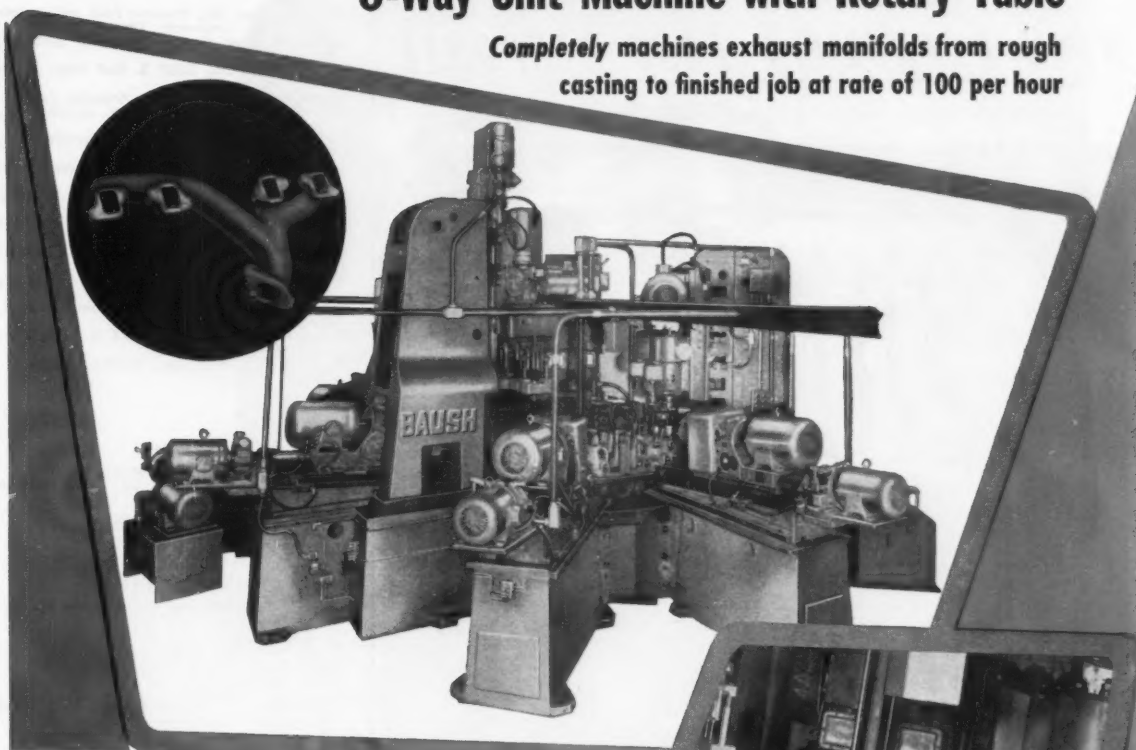
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Completely machines exhaust manifolds from rough casting to finished job at rate of 100 per hour

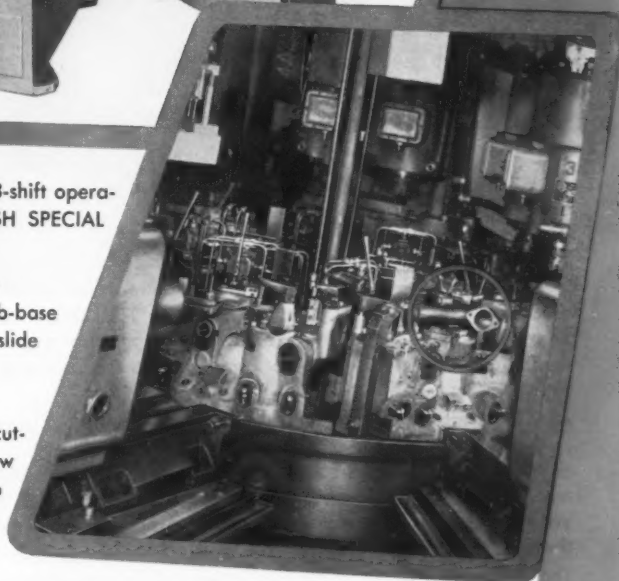


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Cincinnati Gear Co., Wooster Pike and Mariemont Ave., Cincinnati, Ohio
Diefendorf Gear Corp., Box 934, Syracuse, N. Y.
Fairfield Mfg. Co., 2309 S. Earl Ave., Lafayette, Ind.
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Gear Specialties, Inc., 2635 W. Medill Ave., Chicago 47, Ill.
Greaves Machine Tool Co., 2011 Eastern Ave., Cincinnati, Ohio
Horsburgh & Scott Co., 5114 Hamilton, Cleveland, Ohio
Illinois Gear & Mch. Co., 2100 No. Natchez Ave., Chicago 35, Ill.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.
New Jersey Gear Mfg. Co., 1470 Chestnut Ave., Hillside, N. J.
Philadelphia Gear Works, Erie Ave. and G St., Philadelphia, Pa.
Stahl Gear & Mch. Co., 3901 Hamilton Ave., Cleveland 14, Ohio
Verson Allsteel Press Co., 93rd St. & S. Kenwood Ave., Chicago, Ill.
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Jones & Lamson Mch. Co., Springfield, Vt.
Mummert-Dixon Co., Hanover, Pa.
National Acme Co., 170 E. 131st St., Cleveland 8, Ohio
South Bend Lathe Works, South Bend 22, Ind.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio
Thor Power Tool Co., 175 N. State St., Aurora, Ill.
U. S. Burke Machine Tool Div., Brotherton Rd., Cincinnati 27, Ohio

GRINDERS, Corbide Tool

Arter Grinding Mch. Co., 15 Sagamore Rd., Worcester 5, Mass.
Delta Power Tool Div., 400 N. Lexington Ave., Pittsburgh, Pa.
Elox Corp. of Mich., Royal Oak 3, Mich.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Heald Machine Co., 10 New Bond St., Worcester 6, Mass.
Metallurgical Products Dept. of General Electric Co., Box 237 Roosevelt Park Annex, Detroit 32, Mich.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Oliver Instrument Co., 1410 E. Maumee St., Adrian, Mich.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio
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Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio

(Continued on page 362)

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MACHINERY, November, 1956—361

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Oliver Instrument Co., 1410 E. Maumee St., Adrian, Mich.
Standard Electrical Tool Co., 2500 River Rd., Cincinnati 4, Ohio

GRINDERS, Face Mill

Kearny & Trecker Corp., Milwaukee 14, Wis.
Mattison Machine Works, 545 Blackhawk Park Ave., Rockford, Ill.
Oliver Instrument Co., 1410 E. Maumee St., Adrian, Mich.

GRINDERS, Knife and Shear

Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio

Mattison Machine Works, Rockford, Ill.
Mummert-Dixon Co., Hanover, Pa.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio

GRINDERS, Portable Electric

Chicago Pneumatic Tool Co., New York 17, N. Y.
Ingersoll-Rand Co., 11 Broadway, New York 4, N. Y.
Standard Electrical Tool Co., 2500 River Rd., Cincinnati 4, Ohio
Thor Power Tool Co., 175 N. State St., Aurora, Ill.

GRINDERS, Portable Pneumatic

Chicago Pneumatic Tool Co., New York 17, N. Y.
Ingersoll-Rand Co., 11 Broadway, New York 4, N. Y.
Madison-Kipp Corp., Madison, Wis.
Thor Power Tool Co., Aurora, Ill.

GRINDERS, Tap

Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Jones & Lamson Mch. Co., 160 Clinton St., Springfield, Vt.

GRINDERS, Tool and Cutter

Atlas Press Co., 20108 N. Pitcher, Kalamazoo, Mich.
Barber-Colman Co., Rock and Montague, Rockford, Ill.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling and Grinding Mchs., Cincinnati 9, Ohio
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Delta Power Tool Div., 400 Lexington Ave., Pittsburgh, Pa.
Elox Corp. of Mich., Royal Oak 3, Mich.
Fellows Gear Shaper Co., 78 River St., Springfield, Vt.
Gallmeyer & Livingston Co., 336 Straight Ave., S. W., Grand Rapids 4, Mich.
Gleason Works, 1000 University Ave., Rochester 3, N. Y.
Gorton, Geo., Mch. Co., 1321 Racine St., Racine, Wis.
Homstrand, Inc., Larchmont, N. Y.
Landis Tool Co., Waynesboro, Pa.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio
Mummert-Dixon Co., Hanover, Pa.
National Acme Co., 170 E. 131st St., Cleveland 8, Ohio
Norton Co., 1 New Bond St., Worcester 6, Mass.
Oliver Instrument Co., 1410 E. Maumee St., Adrian, Mich.
South Bend Lathe Wks., South Bend 22, Ind.
Thompson Grinder Co., 1500 W. Main St., Springfield, Ohio
Waltham Mch. Wks., Inc., Waltham, Mass.

GRINDERS, Toolpost

Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio

GRINDING GAGES—See Gages, Grinding**GRINDING MACHINES, Abrasive Belt**

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Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio
Mattison Mch. Works, Rockford, Ill.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio
Thor Power Tool Co., 175 N. State St., Aurora, Ill.
Wells Sales Corp., 333 Nassau Ave., Brooklyn 22, N. Y.

GRINDING MACHINES, Broach

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Lapointe Mch. Tool Co., 34 Tower St., Hudson, Mass.
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(Continued on page 364)

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"B" Grade Prices

Rectangular and square sets . . . 5 to 121 pieces

**"B" Grade Discontinued
as Inadequate for Today's Tolerances**

Prevent measurement errors, save time, save money and pay no premium: DoALL "A" Grade gage blocks, with guaranteed tolerances of plus .000004, minus .000002 per inch of length are now available at "B" Grade gage block ($\pm .000008$) prices!

Every set accompanied by a Certified Inspection Report showing calibrated size of each block! Precise calibration made possible by guaranteed 0 to 0.09 RMS surface finish. Superior finish also eliminates abrading action . . . extends useful life of block. Exclusive "burr-proofing" of edges minimizes chance of damage.

Get the facts—find out why "B" grade blocks cannot do today's measurement job. Call your local DoALL Store or write:

FREE—New DoALL Gage Block Catalog listing square and rectangular gage block sets in "A", "AA" and new "AAA" grades. Set sizes range from 5 to 121 blocks. Accessories for assembling fixed or indicating gages. Write today!



FREE—"How to Be Your Own Bureau of Standards"—new 36 page manual on shop inspection and calibration of gage blocks—describes equipment and methods needed to inspect blocks for flatness and wear as well as for accurately calibrating your blocks. Call or write for your copy.

The DoALL Company, Des Plaines, Illinois

Machine Tools • Cutting Tools • Measuring Instruments • Tool Steel

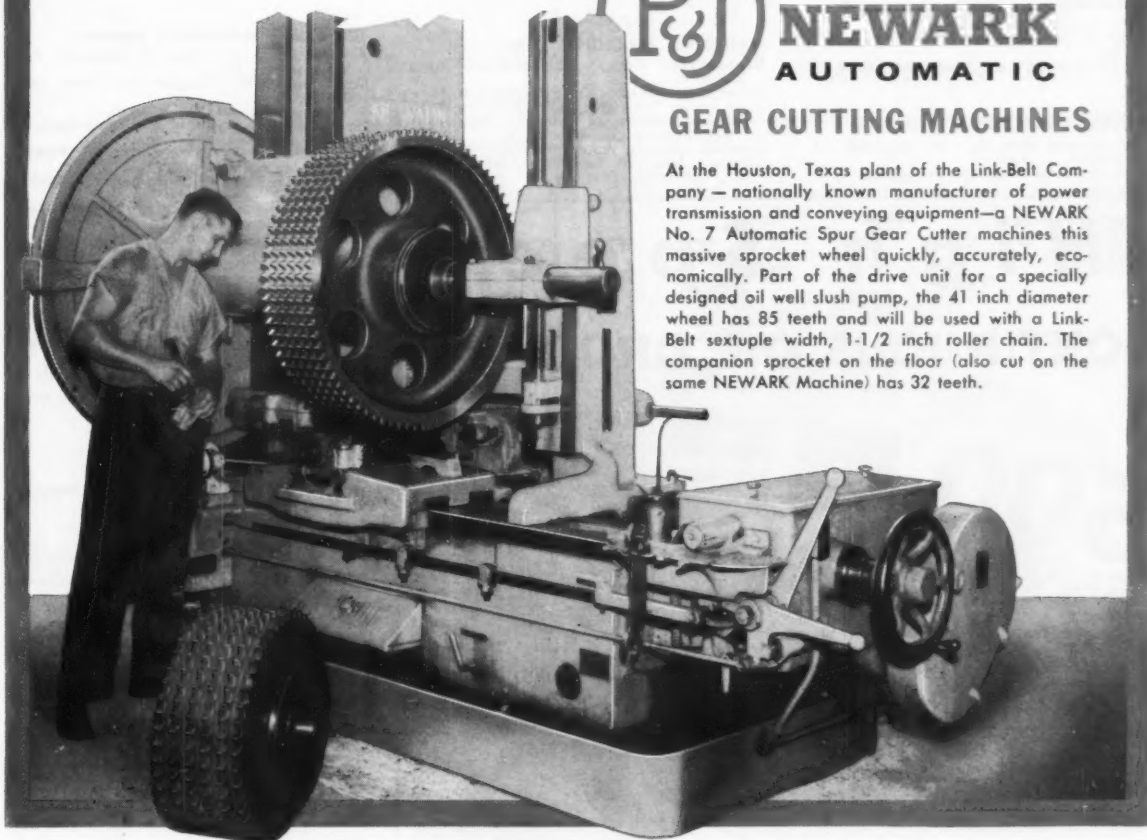
GB 29

Specialists who **KNOW** rely on



**NEWARK
AUTOMATIC**

GEAR CUTTING MACHINES



At the Houston, Texas plant of the Link-Belt Company — nationally known manufacturer of power transmission and conveying equipment—a NEWARK No. 7 Automatic Spur Gear Cutter machines this massive sprocket wheel quickly, accurately, economically. Part of the drive unit for a specially designed oil well slush pump, the 41 inch diameter wheel has 85 teeth and will be used with a Link-Belt sextuple width, 1-1/2 inch roller chain. The companion sprocket on the floor (also cut on the same NEWARK Machine) has 32 teeth.

When selecting a gear cutting machine, specialists who demand the ultimate in fast, accurate, economical production, look for important features like these: fully automatic operation; quick, simple machine setup; extra strength, power and rigidity; and an indexing mechanism *guaranteed* for accuracy. That's the reason specialists, like Link-Belt, who *know* the difference, depend on P&J-Newark Automatic Gear Cutting Machines for their big, tough jobs.

SEND NOW FOR COMPLETE INFORMATION

... see how a P&J-Newark Gear Cutter can bring new efficiency to *your* spur gear production. Several models handle a very wide range of work size requirements. Write for Bulletin No. 157 or call the Pratt & Whitney Branch Office near you and ask a Direct-Factory Representative to call and discuss your requirements.

Potter & Johnston Company,
Pawtucket, Rhode Island
(Subsidiary of Pratt & Whitney Company, Inc.)



POTTER & JOHNSTON

Precision Production Tooling for More Than Fifty Years

AUTOMATIC CHUCKING TURRET LATHES • NEWARK GEAR CUTTING MACHINES

For more information fill in page number on Inquiry Card, on page 275

MACHINERY, November, 1956—363

GRINDING MACHINES, Centerless

Cincinnati Milling and Grinding Mchs., Inc., Cincinnati 9, Ohio
 Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
 Heald Machine Co., 10 New Bond St., Worcester 6, Mass.
 Landis Tool Co., Waynesboro, Pa.
 Triplex Machine Tool Corp., 75 West St., New York 6, N. Y.
 Van Norman Co., Springfield, Mass.

GRINDING MACHINES, Crankshaft

Landis Tool Co., Waynesboro, Pa.
 Norton Co., 1 New Bond St., Worcester 6, Mass.
 Van Norman Mch. Co., Springfield, Mass.

GRINDING MACHINES, Cylindrical

Arter Grinding Mch. Co., 15 Sagamore Rd., Worcester 5, Mass.
 Brown & Sharpe Mfg. Co., Providence, R. I.

Cincinnati Milling and Grinding Mchs., Inc., Cincinnati 9, Ohio
 Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
 Frauenthal Div., Muskegon, Mich.
 Gallmeyer & Livingston Co., 336 Straight, S. W., Grand Rapids 2, Mich.
 Landis Tool Co., Inc., Waynesboro, Pa.
 Norton Co., 1 New Bond St., Worcester 6, Mass.
 Sheffield Corp., Box 893, Dayton 1, Ohio
 Standard Electrical Tool Co., 2500 River Rd., Cincinnati 4, Ohio
 Van Norman Co., 2640 Main St., Springfield 7, Mass.

GRINDING MACHINES, Disc

Besley-Welles Corp., 112 Dearborn Ave., Beloit, Wis.
 Brown & Sharpe Mfg. Co., Providence, R. I.
 Delta Power Tools Div., 400 Lexington Ave., Pittsburgh 8, Pa.
 Gardner Machine Co., Beloit, Wis.
 Mattison Machine Works, Rockford, Ill.
 Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio

GRINDING MACHINES, Gear

Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
 Gear Grinding Mch. Co., 3901 Christopher St., Detroit 11, Mich.
 Gleason Works, 1000 University Ave., Rochester 3, N. Y.
 Lees-Bradner Co., Cleveland, Ohio
 National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.
 Russell, Holbrook & Henderson, Inc., 292 Madison Ave., New York 17, N. Y.
 Sheffield Corp., Box 893, Dayton 1, Ohio

GRINDING MACHINES, Internal

Arter Grinding Mch. Co., 15 Sagamore Rd., Worcester 5, Mass.
 Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
 Frauenthal Div., Muskegon, Mich.
 Gallmeyer & Livingston Co., 336 Straight, S. W., Grand Rapids 2, Mich.
 Heald Machine Co., 10 New Bond St., Worcester 6, Mass.
 Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
 Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio
 Van Norman Mch. Co., Springfield, Mass.
 Wicaco Machine Corp., Wayne Junction, Philadelphia, Pa.

GRINDING MACHINES, Jig

Fosdick Mch. Tool Co., 1638 Blue Rock St., Cincinnati 23, Ohio
 Gallmeyer & Livingston Co., 336 Straight, S. W., Grand Rapids 2, Mich.
 Moore Special Tool Co., Inc., 740 Union Ave., Bridgeport, Conn.

GRINDING MACHINES, Profile

Baker Brothers, Inc., 1000 Post St., Toledo 10, Ohio
 Cincinnati Milling and Grinding Mchs., Inc., Cincinnati 9, Ohio
 Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
 Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
 Jones & Lamson Mch. Co., Springfield, Vt.
 Sheffield Corp., Box 893, Dayton 1, Ohio

GRINDING MACHINES, Surface Reciprocating

Brown & Sharpe Mfg. Co., Providence, R. I.
 Cincinnati Milling and Grinding Mchs., Inc., Cincinnati 9, Ohio
 Delta Power Tool Div., 400 Lexington Ave., Pittsburgh, Pa.
 DoAll Co., Des Plaines, Ill.
 Elox Corp. of Mich., Royal Oak 3, Mich.
 Foote-Burt Co., 13000 St. Clair Ave., Cleveland 8, Ohio
 Gallmeyer & Livingston Co., 336 Straight Ave., S. W., Grand Rapids 4, Mich.
 Gardner Machine Co., Beloit, Wis.
 Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio
 Homestrand, Inc., Larchmont, N. Y.
 Mattison Machine Works, Rockford, Ill.
 Norton Co., 1 New Bond St., Worcester 6, Mass.
 Reid Bros. Co., Inc., Beverly, Mass.
 Thompson Grinder Co., 1500 W. Main St., Springfield, Ohio
 Van Norman Mch. Co., Springfield, Mass.

GRINDING MACHINES, Roll

Landis Tool Co., Waynesboro, Pa.

GRINDING MACHINES, Surface Rotary

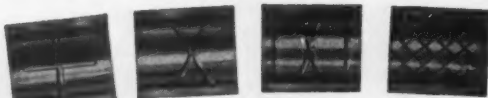
Arter Grinding Mch. Co., 15 Sagamore Rd., Worcester 5, Mass. (Rotary)
 Besley-Welles Corp., 112 Dearborn Ave., Beloit, Wis.
 Blanchard Machine Co., 64 State St., Cambridge, Mass.
 Gardner Machine Co., Beloit, Wis.
 Heald Machine Co., 10 New Bond St., Worcester 6, Mass.
 Mattison Machine Works, Rockford, Ill.
 National Acme Co., 170 E. 131st St., Cleveland 8, Ohio
 Norton Co., 1 New Bond St., Worcester 6, Mass.
 Thompson Grinder Co., 1500 W. Main St., Springfield, Ohio
 Van Norman Mch. Co., Springfield, Mass.
 Walker, O. S. Co., Inc., Worcester, Mass.

(Continued on page 366)

High Speed

CONTINUOUS OIL GROOVING

500



PIECES PER HOUR!

High-production and economical operation are the features of the WICACO CONTINUOUS OIL GROOVER . . . capable of completing as many as 500 grooved pieces per hour in routine practice—even with unskilled labor!

The operator loads and unloads the work **without stopping the Machine**—a valuable time-saving advantage made possible by the WICACO upright construction of the spindle and stationary chuck. Feed-lever automatically returns to neutral position when cutting tool reaches its proper depth. The spindle—not the chuck—revolves, permitting fast and convenient grooving of a variety of larger and irregular work. Maximum depth of groove 7/32", maximum width 3/8", grooves may be cut in work from 1/4" I.D. to 4 1/2" I.D.; standard chuck holds work to 4 1/2" O.D.; stroke of spindle from 0" to 7"; floor space 24" dia.; weight of machine about 950 lbs.

Send us sample bearings to cut to specifications. We will return them, properly grooved, with a record of the time required and a cost-estimate. No obligation. Or, write for detailed, well-illustrated Bulletin.



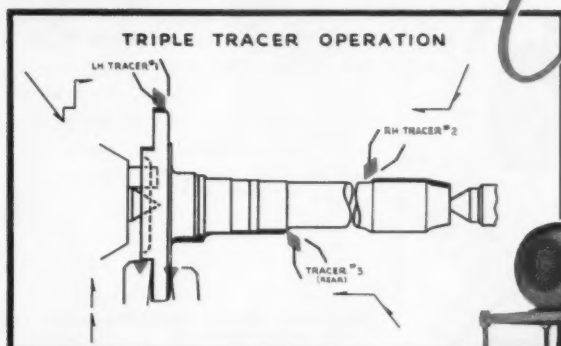
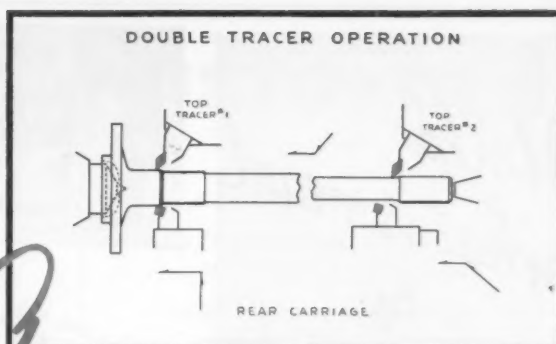
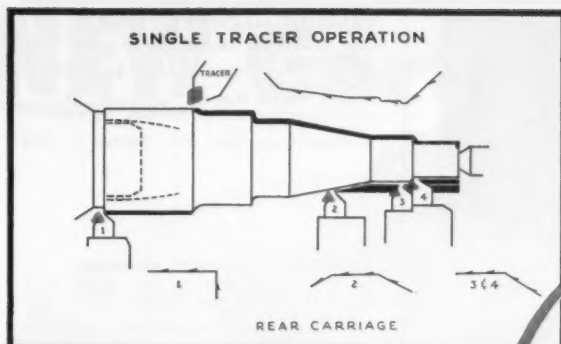
WICACO

SINCE 1868

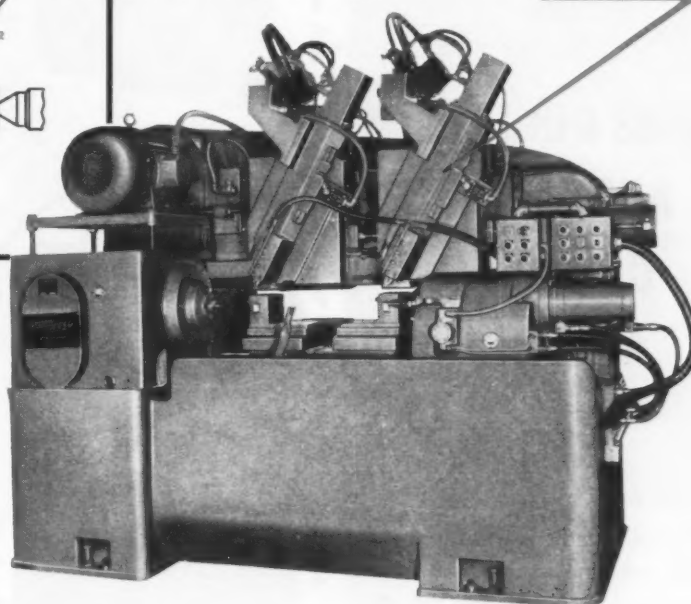
THE WICACO MACHINE CORPORATION

WAYNE JUNCTION

PHILADELPHIA 44, PA.



Another Hydra-Feed Exclusive



Single, Double, Triple, RH or LH Tracer Combinations

Rough and finish turn such parts as axle shafts, camshafts, stem pinions, etc., in one setup using the right combination of tracer and rear carriage tooling. Roughing is done with rear carriage tools and finishing with one, two or three tracers—either right or left hand. Three standard models, HDT-8, HDT-12 and HDT-16, enable you to get the best machine for the job.

Either one or two tracers are mounted on the distinctive Hydra-Feed pioneered top carriage—a production proved feature of Hydra-Feed machines since 1946. A third tracer, when required, is mounted on the rear carriage.

With Hydra-Feed top-tracer lathes you also get:

- Quick changeover due to the unobstructed-front design.
- Location of tracers and templates above workpiece—dirt, chips and cutting oils can't interfere with accuracy or performance.
- Easy automation due to the open front design and the ability to pass work straight through the machine under the top carriage.
- Unmatched chip capacity with the oversize chip chute located below the entire work area. Chips can be removed automatically through the end, rear or bottom of the machine.

Ask for Bulletin HDT-55



HYDRA-FEED MACHINE TOOL CORPORATION

SOUTH NORWALK, CONNECTICUT AND DETROIT (Ferndale), MICHIGAN

Address all inquiries to:

SALES AND ENGINEERING OFFICE, 730 W. EIGHT MILE ROAD, FERNDALE, MICHIGAN

*Here's
what is meant
by*

"1-2-3"

in the

GOSS & DE LEEUW AUTOMATIC CHUCKING MACHINE

The outstanding advantage of this machine is ability to handle operations on one, two or three ends of a piece simultaneously or in sequence, without changing set-up or rehandling. It is the only standard machine that will do this.

"1-2-3" means ability to handle work requiring machining operations on one, two or three ends simultaneously or in sequence—a method exclusive with Goss & DeLeeuw and offered on this machine.

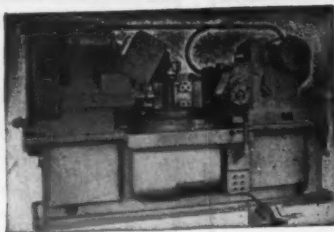


For complete details ask for illustrated bulletin. Send samples of your work for time and cost estimates.



GOSS and DE LEEUW

MACHINE COMPANY, KENSINGTON, CONN., U.S.A.



GRINDING MACHINES, Thread

Casa Corp., 405 Lexington Ave., New York 17, N. Y.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Jones & Lamson Mch. Co., Springfield, Vt.
Landis Machine Co. (Centerless), Waynesboro, Pa.
Sheffield Corp., Box 893, Dayton 1, Ohio

GRINDING MACHINES, Universal

Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling and Grinding Mchs., Inc., Cincinnati 9, Ohio
Casa Corp., 405 Lexington Ave., New York 17, N. Y.
Frauenthal Div., Muskegon, Mich.
Galmeier & Livingston Co., 336 Straight, S. W., Grand Rapids 2, Mich.
Gorton Mch. Co., Geo., 1321 Racine St., Racine, Wis.
Jones & Lamson Mch. Co., Springfield, Vt.
Landis Tool Co., Waynesboro, Pa.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Oliver Instrument Co., 1410 E. Maumee St., Adrian, Mich.
Rivett Lathe & Grinder, Inc., Brighton 35, Boston, Mass.
Springfield Mch. Tool Co., 613 W. Southern Ave., Springfield, Ohio

GRINDING WHEEL DRESSING AND FORMING DEVICES

Besley-Welles Corp., 112 Dearborn Ave., Beloit, Wis.
Brown & Sharpe Mfg. Co., Providence, R. I.
DoALL Co., Des Plaines, Ill.
Jones & Lamson Mch. Co., Springfield, Vt.
Metal Carbides Corp., Youngstown, Ohio
Moore Special Tool Co., Inc., 740 Union Ave., Bridgeport 7, Conn.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Sheffield Corp., Box 893, Dayton 1, Ohio

GRINDING WHEELS

Bakelite Co., Div. of Union Carbide & Carbon Corp., 30 E. 42nd St., N. Y., N. Y.
Besley-Welles Corp. (Abrasive Div.), 20 N. Wacker Drive, Chicago 6, Ill.
Blanchard Machine Co., 64 State St., Cambridge, Mass.
Cincinnati Milling and Grinding Mchs., Inc., Cincinnati 9, Ohio
Cincinnati Milling Products Div., Cincinnati 9, Ohio
Cratex Manufacturing Co., 81 Natoma St., San Francisco, Calif.
Delta Power Tool Div., 400 N. Lexington Ave., Pittsburgh 8, Pa.
DoALL Co., 254 N. Laurel Ave., Des Plaines, Ill.
Gardner Machine Co., Beloit, Wis.
Metal Carbides Corp., Youngstown, Ohio
Norton Co., 1 New Bond St., Worcester 6, Mass.
Simonds Abrasive Co., Tacony and Fraley St., Bridgesburg, Philadelphia, Pa.
Sterling Grinding Wheel Co., Tiffin, Ohio

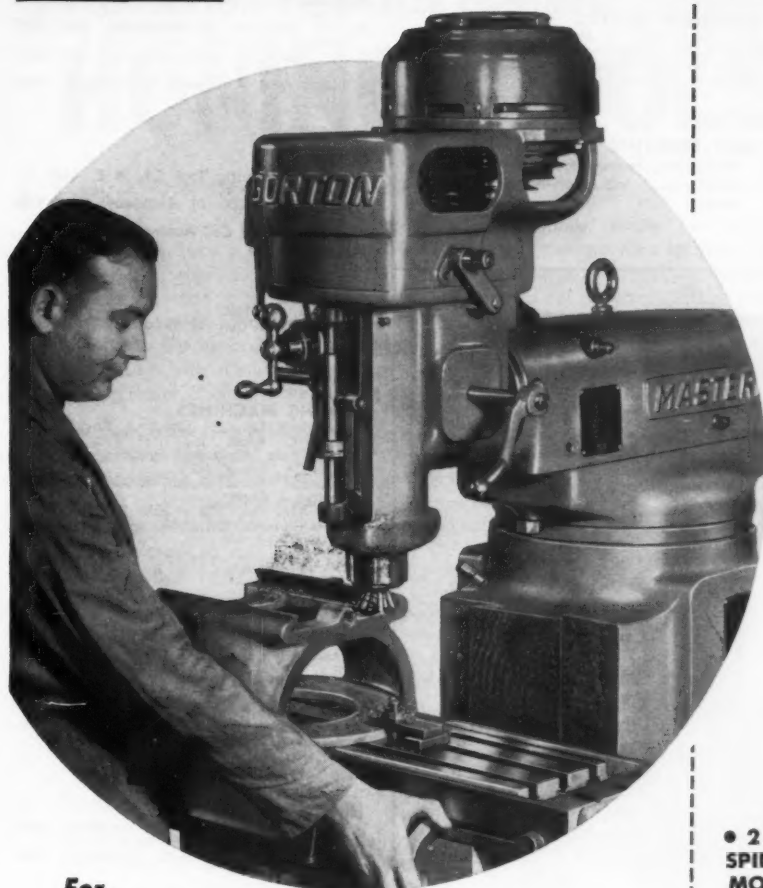
GROOVING TOOLS, Internal

Scully-Jones & Co., 1906 So. Rockwell St., Chicago 8, Ill.
Wesson Co., 1220 Woodward Heights Blvd., Detroit 20, Mich.

HAMMERS, Drop—See Forging Hammers

(Continued on page 368)

NEW Gorton Mastermil



For...

Milling, boring, duplicating in tool rooms, model shops, pattern shops, production lines, general machine shops, experimental laboratories, machine shops, schools — wherever high-speed vertical milling is done.

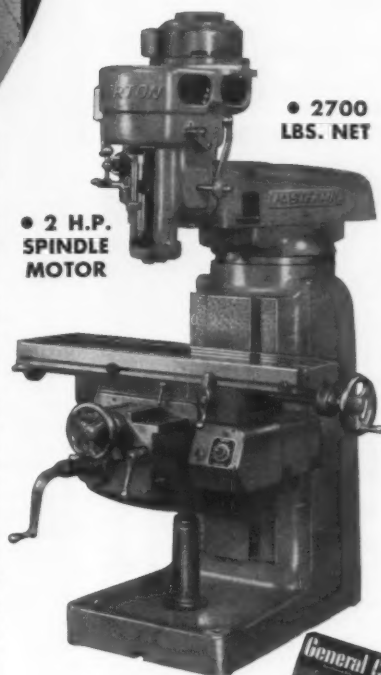
Also available...

Infinitely variable spindle feed from $\frac{1}{4}$ inch to 8 inches per minute.

Infinitely variable table feed (longitudinal) in 4 ranges: from $\frac{1}{2}$ inch to 60 inches per minute.

Ask for special bulletin, No. 2699, on new Gorton Mastermil and for general catalog, 1311-1655, covering the entire Gorton line.

- PRECISION SPINDLE; 10 SPEEDS, 80-5600 R.P.M. STANDARD
- DESIGNED AND BUILT TO PROVIDE SUSTAINED ACCURACY
- LONGITUDINAL FEED, 22 INCHES
- SADDLE LENGTH, 24 INCHES
- CROSS FEED, $10\frac{1}{2}$ INCHES
- VERTICAL FEED OF KNEE, $15\frac{1}{2}$ INCHES
- SPINDLE FEED, 4 INCHES



• 2700
LBS. NET

• 2 H.P.
SPINDLE
MOTOR



SINCE 1893

GEORGE GORTON MACHINE CO.

1311 RACINE ST.

RACINE, WISCONSIN

56-1

Tracer-Controlled Pantographs, Duplicators — standard and special... Horizontal and Vertical Mills, Swiss-Type Screw Machines, Tool Grinders, Small Tools and Accessories.

For more information fill in page number on Inquiry Card, on page 275

MACHINERY, November, 1956—367

A 8732-1P

HAMMERS, Portable Electric

Ingersoll-Rand Co., 11 Broadway, New York 4, N. Y.
Thor Power Tool Co., Aurora, Ill.

HAMMERS, Portable Pneumatic

Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
Ingersoll-Rand Co., 11 Broadway, New York 4, N. Y.
Thor Power Tool Co., 175 N. State St., Aurora, Ill.

HAMMERS, Power

Chambersburg Engrg. Co., Chambersburg, Pa.
Edlund Mchry. Co. Div., Cortland, N. Y.
Erie Foundry Co., Erie, Pa.
Yoder Co., 5504 Walworth Ave., Cleveland 2, Ohio.

HARDENING FURNACES

Ajax Electric Co., Frankford at Delaware, Philadelphia 23, Pa.
General Electric Co., Schenectady, N. Y.

HARDNESS TESTERS

Shore Instrument & Mfg. Co., 90-35C Van Wyck Exp., Jamaica 35, N. Y.
Wilson Mechanical Instrument Co., Inc., 230-D Park Ave., New York, N. Y.

HEAT-TREATING EQUIPMENT—See

Annealing Furnaces, Flame Hardening Machines, Induction-heating Equipment

HOBBS

Barber-Colman Co., Rock and Montague, Rockford, Ill.
Goddard & Goddard Co., Detroit, Mich.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
National Twist Drill & Tool Co., Rochester, Mich.
Russell, Holbrook & Henderson, Inc., 292 Madison Ave., New York 17, N. Y.
Star Cutter Co., 34500 Grand River, Farmington, Mich.
Waltham Mch. Wks., Inc., Waltham 54, Mass.

HOISTS, Air

Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
Ingersoll-Rand Co., 11 Broadway, New York 4, N. Y.
Thor Power Tool Co., Aurora, Illinois

HOISTS, Electric

Ingersoll-Rand Co., 11 Broadway, New York 4, N. Y.

HONING MACHINES

Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Fulmer, C. Allen Co., 1231 First National Bank Bldg., Cincinnati 2, Ohio
Jes-Cal Co., Fraser, Mich.
Micromatic Hone Corp., 8100 Schoolcraft, Detroit 4, Mich.
Moline Tool Co., 102 - 20th St., Moline, Ill.
Sunnen Products Co., 7900 Manchester Ave., St. Louis 17, Mo.
Van Norman Mch. Co., 3640 Main St., Springfield 7, Mass.

HONING STONES

Barnes Drill Co., 814 Chestnut St., Rockford, Ill.
Jes-Cal Co., Fraser, Mich.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Sunnen Products Co., 7900 Manchester Ave., St. Louis 17, Mo.

HOSE

American Metal Hose Br., American Brass Co., 25 Broadway, New York, N. Y.
Schrader's Son, A., 470 Vanderbilt Ave., Brooklyn 38, N. Y.

HYDRAULIC MACHINERY**Tools and equipment**

Baldwin-Lima-Hamilton Corp., Eddystone Div., Philadelphia 42, Pa.
Barnes Drill Co., 814 Chestnut St., Rockford, Ill.
Bethlehem Steel Corp., Bethlehem, Pa.
Birdsboro Steel Fdry. & Mch. Co., Birdsboro, Pa.
Bliss, E. W., Co., 1375 Raff Rd., S. W., Canton, Ohio.
Chambersburg Engrg. Co., Chambersburg, Pa.
Colonial Broach & Machine Co., P.O. Box 37, Harper Sta., Detroit 13, Mich.
Cross Co., 3250 Bellevue Ave., Detroit 7, Mich.
Denison Engrg. Co., 1160 Dublin St., Columbus 16, Ohio.
Erie Foundry Co., Erie, Pa.
Farquhar, A. B., Div. Oliver Corp., York, Pa.
Hannifin Corp., 501 S. Wolf Rd., Des Plaines, Ill.
Hydraulic Press Mfg. Co., Mount Gilead, Ohio.
Lake Erie Engrg. Corp., Kenmore Station, Buffalo, N. Y.
Michigan Drill Head Co., Detroit 34, Mich.
Modern Ind. Engrg. Co., 14230 Birwood Ave., Detroit 4, Mich.
Match & Merryweather Machinery Co., Penton Bldg., Cleveland, Ohio.
Oilgear Co., 1569 W. Pierce St., Milwaukee, Wis.
Rockford Mch. Tool Co., 2500 Kishwaukee St., Rockford, Ill.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
Verson Allsteel Press Co., 93rd St., & S. Kenwood Ave., Chicago, Ill.
Vickers Incorporated, Div. of Sperry Rand Corp., 1402 Oakman Blvd., Detroit, Mich.
Wilson, K. R., Inc., 211 Mill St., Arcade N. Y.

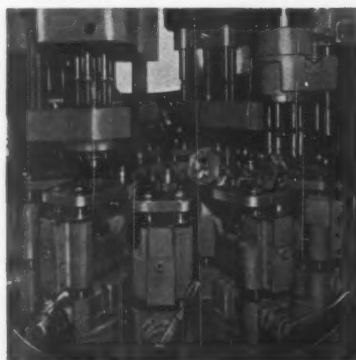
(Continued on page 370)

MILLHOLLAND

12-Station Vertical Indexing Machine 34 Spindles

93 Pieces per Hour!

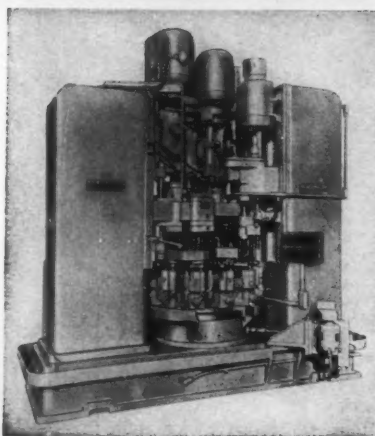
Here is Millholland versatility in action!



Unique Holding Fixture

With a 31-second cycle time, this machine produces 93 pieces per hour at 80% efficiency! This chip cutting efficiency is made possible by the distinctive design of the plate type cam used in Millholland Automatic Units, plus the action of the pneumatic counterbalance.

Two No. 5 Units are mounted vertically, the first with 22 spindles, the second with 5; a No. 2 unit is mounted horizontally on a rapid travel slide, and an Automatic



Lead Screw Tapper with reversing motor drives a 6-spindle tapping head. All machine elements are electrically synchronized, with push-button control for "cycle start," automatic single cycle, set-up and emergency stop. Chip disposal is simplified with wiper blades rotating within a ring on the index table to bring chips to a removable pan.

Part requirements dictated location using self-centering horizontal vees with up-acting clamps, actuated by a single handle operating through a small arc. Fixtures also contain register pins for all bushing plates. The 12 fixtures are mounted on an independently powered automatic index table with self-contained lubrication pump.

A complex production problem, solved efficiently with Millholland equipment and Millholland know-how.

Write for Bulletin M-11 giving further details.

W. K. MILLHOLLAND MACHINERY CO.
6402 Westfield Blvd. Indianapolis 20, Indiana

all you've wanted in PRODUCTION TYPE—SIZE CONTROL HONING TOOLS

► DESIGN AND OPERATING SIMPLICITY

A new rigid shaft construction, without "universal joints" makes the Jes-Cal size control hone a solidly supported extension of the machine spindle. This construction eliminates the need for actuating bushings and bushing bracket, permits generation of bore accuracy and correction of error within limits of only a few ten-thousandths of an inch, closer parallelism of bore axes as in cylinder blocks, and eliminates "swipes" as the tool leaves the bore. Simpler tool design with relatively fewer, precision built parts minimizes chatter, permitting faster, cooler, more positive cutting action with lower cutting pressure.

The Jes-Cal size control gage is positioned around the honing tool spindle. It has carbide tipped contact points for long, hard service of many months without losing size, and is the most positive, dependable and economical method of size control available. This gage stops honing action immediately and automatically, through a simple limit switch, when the gage enters the bore.

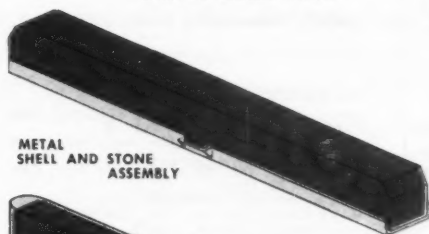
► DEPENDABLE MACHINING ACTION

The Jes-Cal rigid shaft construction delivers a maximum of spindle power application, permits extremely fast and efficient stock removal, and makes possible corrections of large amounts of error such as out-of-roundness, snakiness, bell mouth and taper. Bore accuracy may be held easily within the range of 0.0001 to 0.0005-inch limits in most applications.

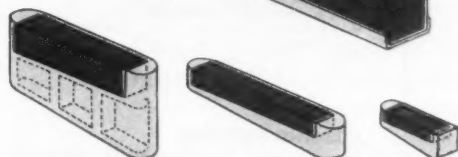
► LOWER OPERATING COSTS

The above features with their many refinements permit Jes-Cal size control honing tools to record much lower operating costs in production as compared with previous experience.

Write for Bulletin JC-101



METAL
SHELL AND STONE
ASSEMBLY



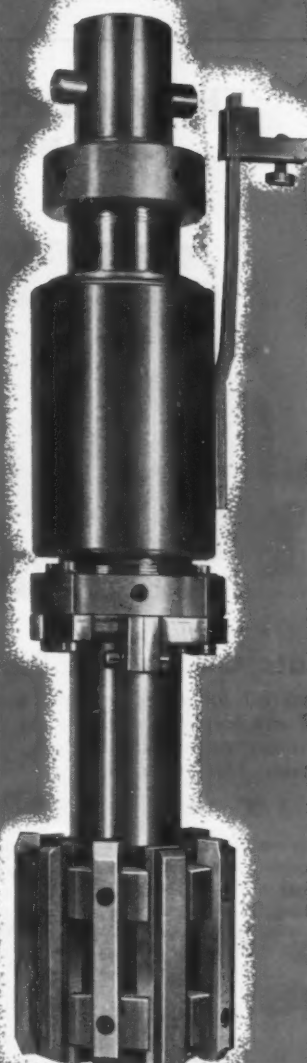
JES-CAL PLASTIC MOUNTED STONES
WITH LEADING EDGE AND SIDE OPEN



SMALL DIAMETER
SIZE CONTROL
HONING TOOL



CON ROD
SIZE CONTROL
HONING TOOL



CYLINDER BORE
SIZE CONTROL
HONING TOOL



JES-CAL COMPANY

31485 GROESBECK HIGHWAY

FRASER, MICHIGAN

HYDRAULIC POWER UNITS OR TOOL HEADS

Barnes Drill Co., 814 Chestnut, Rockford 3, Ill.
 Barnes, W. F. & John Co., 201 S. Waterford St., Rockford, Ill.
 Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
 Hannifin Corp., 501 S. Wolf Rd., Des Plaines, Ill.
 Hartford Special Machinery Co., 287 Homestead Ave., Hartford 12, Conn.
 Hydraulic Press Mfg. Co., Mount Gilead, Ohio.
 Michigan Drill Head Co., Detroit 34, Mich.
 Oilgear Co., 1569 W. Pierce St., Milwaukee, Wis.
 Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
 Vickers Incorporated, Div. of Sperry Rand Corporation, 1402 Oakman Blvd., Detroit, Mich.

INDEXING and SPACING EQUIPMENT

Austin Industrial Corp., White Plains, N. Y.
 Brown & Sharpe Mfg. Co., Providence, R. I.
 Eisler Engrg. Co., Inc., 750 South 13th St., Newark, N. J.
 Ettco Tool Co., Inc., 594 Johnson Ave., Brooklyn 37, N. Y.
 Hardinge Bros., Inc., 1420 College Ave., Elmhurst, N. Y.
 Kearney & Trecker Corp., 6784 W. National, Milwaukee 14, Wis.
 Michigan Drill Head Co., Detroit 34, Mich.
 Micro-Positioner Corp., 716 Wilshire Blvd., Santa Monica, Calif.
 Nichols-Morris Corp., 76 Mamaroneck Ave., White Plains, N. Y.
 Opto-Metric Tools, Inc., 137 Varick St., New York, N. Y.
 Sundstrand Mch. Tool Co., 2531 - 11th St., Rockford, Ill.
 Van Norman Mch. Co., 3640 Main St., Springfield 7, Mass.
 Wadell Equip. Co., Clark, N. J.

INDICATOR BASES, Magnetic

Brown & Sharpe Mfg. Co., 235 Promenade St., Providence 1, R. I.
 DoALL Co., Des Plaines, Ill.
 duMont Corp., 289 Wells St., Greenfield, Mass.
 Starrett, L. S. Co., Athol, Mass.

INDICATOR LIGHTS—See Lights, Indicator**INDICATORS, Dial**

Ames, B. C., Waltham 54, Mass.
 Brown & Sharpe Mfg. Co., Providence, R. I.
 DoALL Co., 254 N. Laurel Ave., Des Plaines, Ill.
 Federal Products Corp., P. O. Box 1027, Providence, R. I.
 National Automatic Tool Co., S. 7th - N. Sts., Richmond, Ind.
 Standard Gage Co., Inc., Poughkeepsie, N. Y.
 Starrett, The L. S. Co., Athol, Mass.

INDICATORS, Speed

Brown & Sharpe Mfg. Co., Providence, R. I.
 General Electric Co., Schenectady, N. Y.
 Reliance Elec. & Engrg. Co., 1200 Ivanhoe Rd., Cleveland 10, Ohio
 Starrett, The L. S. Co., Athol, Mass.

INDICATORS, Test

Brown & Sharpe Mfg. Co., Providence, R. I.
 Federal Products Corp., P. O. Box 1027, Providence, R. I.
 National Automatic Tool Co., S. 7th - N. Sts., Richmond, Ind.
 Starrett, The L. S. Co., Athol, Mass.

INDUCTION HEATING EQUIPMENT

Cincinnati Milling & Grinding Mchcs., Inc., 4701 Marburg Ave., Cincinnati 9, Ohio
 General Electric Co., Schenectady, N. Y.
 Ohio Crankshaft Co., 3800 Harvard Ave., Cleveland, Ohio

INTENSIFIERS, Hydraulic

Hydraulic Press Mfg. Co., Mount Gilead, Ohio
 Logansport Mch. Co., Inc., Logansport, Ind.
 Oilgear Co., 1560 W. Pierce St., Milwaukee 4, Wis.
 Rivett Lathe & Grinder, Inc., Brighton 35, Boston, Mass.

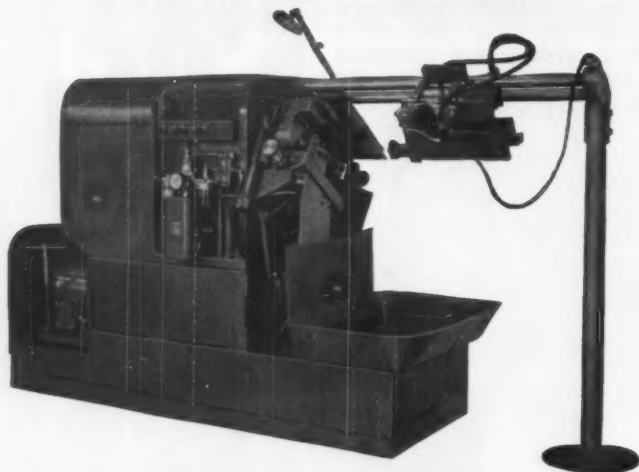
JACKS, Planer—See Set-up Equipment**JIG BORERS**

American Sip Corp., 100 E. 42nd St., New York 17, N. Y.
 Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
 Fosdick Mch. Tool Co., 1638 Blue Rock, Cincinnati 23, Ohio
 Homestrand, Inc., Larchmont, N. Y.
 Moore Special Tool Co., Inc., 724 Union Ave., Bridgeport, Conn.
 Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.

JIGS AND FIXTURES

Acromark Co., 9-11 Morrell St., Elizabeth, N. J.
 Bath, Cyril Co., Aurora & Solon Road, Solon, Ohio
 Columbus Die, Tool & Mch. Co., 955 Cleveland Ave., Columbus, Ohio
 Conforming Matrix Corp., Toledo, Ohio
 Hartford Special Mchry. Co., 287 Homestead Ave., Hartford, Conn.
 Metal Carbides Corp., Youngstown 12, Ohio
 Modern Industrial Engrg. Co., 14230 Birwood Ave., Detroit 28, Mich.
 Portage Mch. Co., 1025 Sweitzer Ave., Akron 11, Ohio
 Sheffield Corp., 721 Springfield St., Dayton 1, Ohio
 Waltham Mch. Wks., Inc., Waltham 54, Mass.

The MODERN AUTOMATIC CUTTING-OFF MACHINE

**Cuts Off Tubing, Pipe and Shafting . . . FAST**

Cuts off longer pieces than a regular automatic machine. In fact, cuts off *any length you want*—and cuts it *faster*. If your production *requires* quantity cutting-off of tubing, pipe or shafting, check the figures below against your present time.

1 1/2" Tubing

This machine cuts off and chamfers both outside edges of 1/2" .030 wall tubing, 5' long, at the rate of one every 2.5 seconds.

1 1/4" Cold Rolled

This machine cuts off and chamfers both ends of 1 1/4" cold rolled, 20" long, at the rate of one every 20 seconds.

1" Tubing

This machine cuts off and chamfers both outside edges of 3" long, at the rate of one every 3 seconds.

These popular, time saving machines are now available in four sizes, handling work up to 6 3/4" O.D. Their many cost cutting features are described and illustrated in our latest catalog that will be mailed promptly on request.

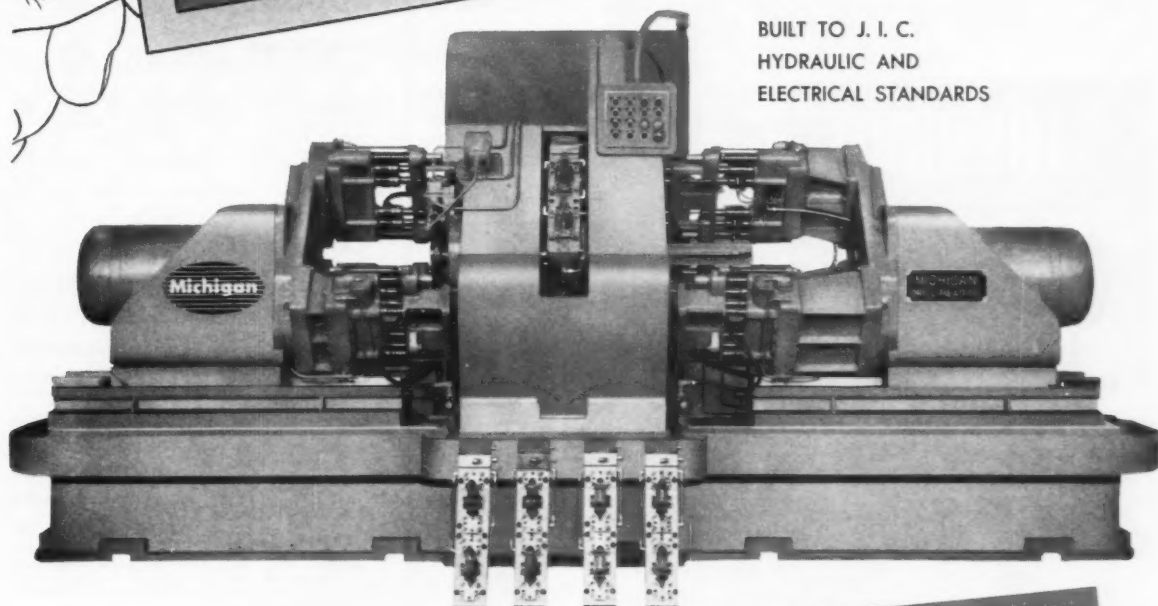
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MODERN MACHINE TOOL CO.
 Jackson, Michigan

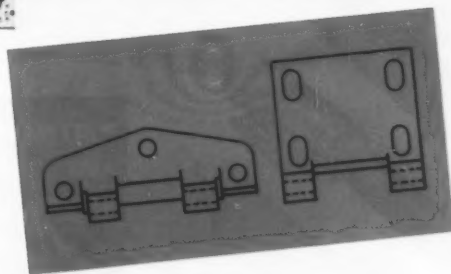


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AUTOMATICALLY
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HINGES PER HOUR**

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HYDRAULIC AND
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- Double end, 4-place, 4-station machine.
- Way type hydraulic feed.
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We also invite your inquiries regarding our full line of tapping units, and index tables, manual and automatic.



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engineers and manufacturers of production machines and drilling equipment

KEYSEATERS

Baker Bros., Inc., Station F, P. O. Box 101, Toledo 10, Ohio
 Bliss, E. W. Co., Canton, Ohio
 Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
 Davis Keyseater Co., 405 Exchange St., Rochester 8, N. Y.
 Heller Tool Co., Heller Dr., Newcometown, Mich.
 Mitts & Merrill, 1809 S. Water St., Saginaw,

LAPPING MACHINES

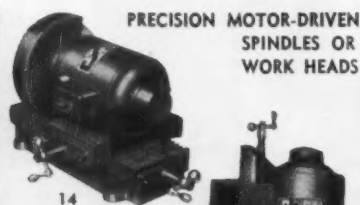
Cincinnati Milling & Grinding Mches., Inc., 4701 Marburg Ave., Cincinnati 19, Ohio
 Crane Packing Co., 1800 Cuyler Ave., Chicago, Ill. (Lapmaster Div.)
 DoALL Co., Des Plaines, Ill.

Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
 Gleason Works, 1000 University Ave., Rochester, N. Y.
 Micromatic Hone Corp., 8100 Schoolcraft, Detroit 4, Mich.
 Norton Co., 1 New Bond St., Worcester 6, Mass.
 Size Control Co., Div. of American Gage & Mch. Co., 2500 W. Washington Blvd., Chicago 12, Ill.

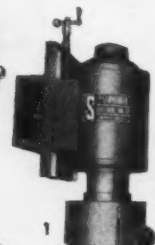
LATHE ATTACHMENTS

Atlas Press Co., Kalamazoo, Mich.
 Axelson Mfg. Co., P. O. Box 15335, Vernon Sta., Los Angeles 58, Calif.
 Delta Power Tool Div., Rockwell Mfg. Co., Pittsburgh, Pa.

Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
 Hardinge Bros., Inc., 1420 College Ave., Elmira, N. Y.
 Jones & Lamson Mch., 512 Clinton St., Springfield, Vt.
 LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio
 Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio
 Nebel Mch. Tool Corp., 3401 Central Parkway, Cincinnati 25, Ohio
 Sheldon Mch. Co., Inc., 4258 N. Knox Ave., Chicago 41, Ill.
 South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
 Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.



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- ★ DYNAMICALLY BALANCED
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 PRECISION SPINDLES AND MACHINE TOOLS
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LATHES, AUTOMATIC—See Chucking Machines**LATHES, Axle**

Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio
 Consolidated Mch. Tool Div., Farrel-Birmingham Co., Inc., Rochester 10, N. Y.
 Monarch Mch. Tool Co., Oak St., Sidney, Ohio
 Seneca Falls Mch. Co., Seneca Falls, N. Y.
 Sundstrand Mch. Tool Co., 2531 - 11th St., Rockford, Ill.

LATHES, Bench

Atlas Press Co., Kalamazoo, Mich.
 Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
 Hardinge Bros., Inc., 1420 College Ave., Elmira, N. Y.
 Homstrand, Inc., Larchmont, N. Y.
 LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio
 Levin, Louis & Son, Los Angeles 21, Calif.
 Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
 Sheldon Mch. Co., Inc., 4240-4258 N. Knox Ave., Chicago 41, Ill.
 South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.

LATHES, Boring

Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Cal.
 Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio
 Bullard Co., Brewster St., Bridgeport 2, Conn.
 Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
 LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio
 Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio
 Sidney Machine Tool Co., Sidney, Ohio
 Wickes Brothers, 512 No. Water St., Saginaw, Mich.

LATHES, Car Wheel

Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio
 Bullard Co., Bridgeport 6, Conn.
 Consolidated Mch. Tool Div., Blossom Road, Rochester 10, N. Y.

LATHES, Crankshaft

Consolidated Mch. Tool Corp., Rochester, N. Y.
 LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio
 Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
 Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
 Wickes Brothers, 512 No. Water St., Saginaw, Mich.

LATHES, Double-End

Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio
 Cleveland Automatic Machine Co., 4932 Beech St., Cincinnati 12, Ohio
 (Continued on page 374)

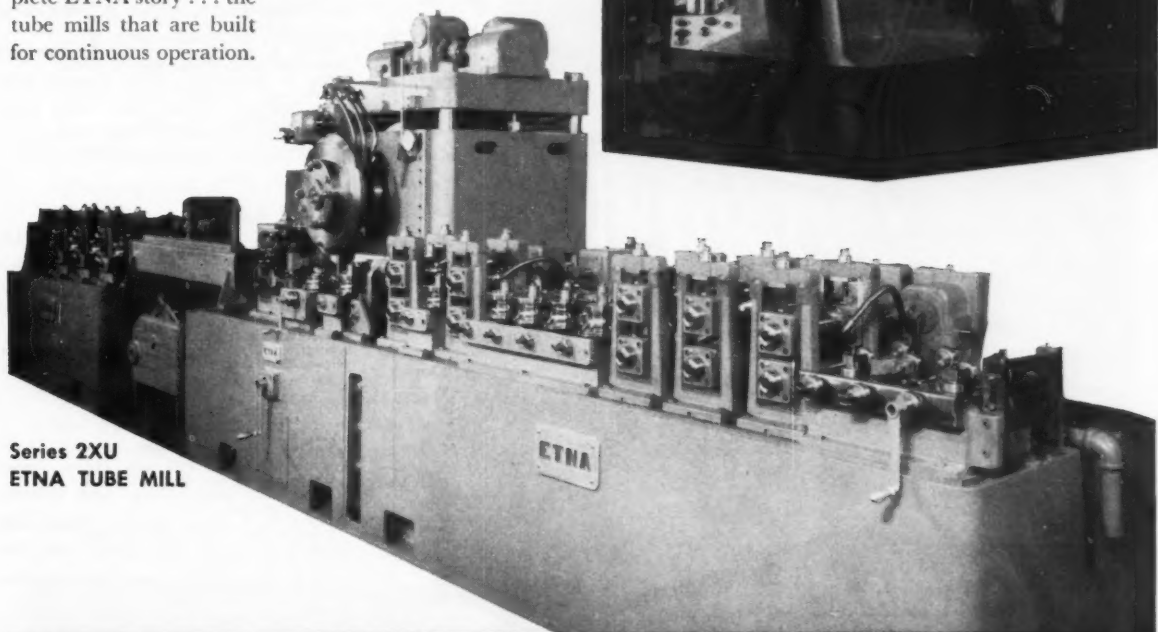
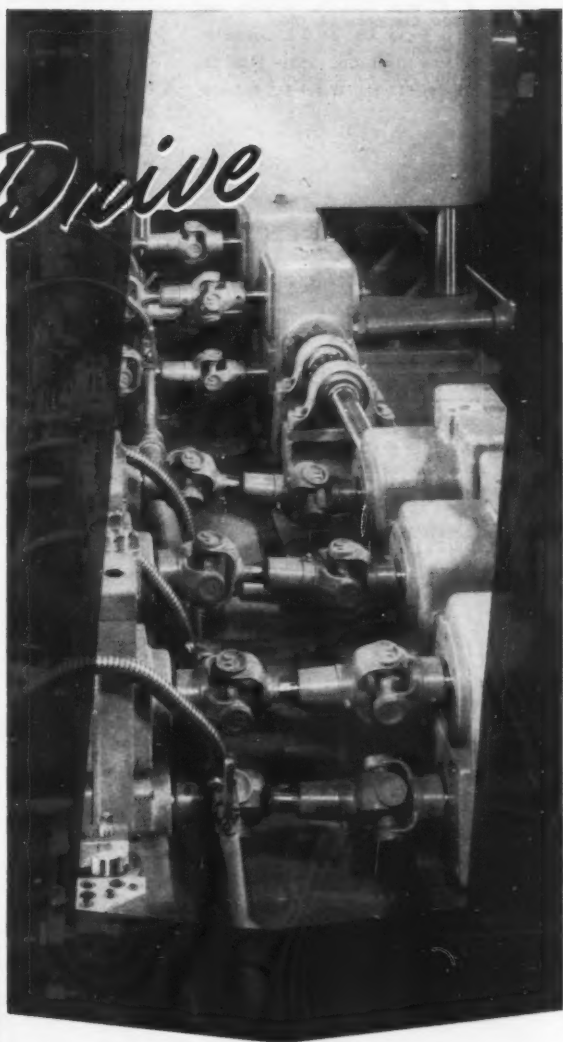
THE **ETNA** *Universal Drive*

- assures **GREATER ACCURACY**
 - permits **EASIER CHANGE-OVER**
- in the production of welded Steel Tubing**

The advanced design-engineering featured in Etna Tube Mills provides precision and permits flexibility in the forming of welded steel tube that has created outstanding acceptance by the industry.

The Etna Universal Drive provides (1) greater accuracy in the forming of tube, and (2) allows for an easier change from the manufacture of one diameter tube to another.

There are many more features, too, that contribute to overall operating efficiency and economy. Be sure to get the complete ETNA story . . . the tube mills that are built for continuous operation.



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ETNA TUBE MILL**

the **ETNA** machine company
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EAST INDIANA AVENUE • PERRYSBURG, OHIO

Consolidated Mch. Tool Corp., Rochester, N. Y.
LeBlond, R. K., Mch. Tool Co., Madison and
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Snyder Tool & Engrg. Co., 3400 E. Lafayette,
Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 11th St.,
Rockford, Ill.
Wickes Brothers, 512 No. Water St., Saginaw,
Mich.

LATHES, Duplicating

Axelson Mfg. Co., 6160 S. Boyle Ave., Los
Angeles 58, Calif.
Baldwin-Lima-Hamilton Corp., Lima Hamilton
Div., Hamilton, Ohio.
Hydra-Feed Machine Tool Corp., 730 W. Eight
Mile Rd., Ferndale 20, Mich.
Lodge & Shipley Co., 3055 Colerain Ave., Cin-
cinnati 25, Ohio.
Monarch Machine Tool Co., 27 Oak St., Sidney,
Ohio.
Sidney Machine Tool Co., Sidney, Ohio.
Triplex Machine Tool Corp., 75 West St., New
York 14, N. Y.

LATHES, Engine, Manufacturing

American Tool Works Co., Pearl and Eggleston
Aves., Cincinnati, Ohio.
Atlas Press Co., Kalamazoo, Mich.
Axelson Mfg. Co., 6160 S. Boyle Ave., Los
Angeles 58, Calif.
Barber-Colman Co. (Hendey Mch. Div.), Rock-
ford, Ill.
Carroll-Jamieson Mch. Tool Co., Batavia,
Ohio.
Cincinnati Lathe & Tool Co., 3207-3211 Dis-
ney St., Oakley, Cincinnati 9, Ohio.
Consolidated Mch. Tool Div., Blossom Road,
Rochester 10, N. Y.
Cosa Corp., 405 Lexington Ave., New York
17, N. Y.
Delta Power Tool Div., Rockwell Mfg. Co.,
Pittsburgh, Pa.
Homestrand, Inc., Larchmont, N. Y.
Hydra-Feed Mch. Tool Corp., 730 W. 8 Mile
Rd., Ferndale 20, Mich.
LeBlond, R. K., Mch. Tool Co., Madison and
Edwards Rds., Cincinnati 18, Ohio.
Lodge & Shipley Co., 3055 Colerain Ave.,
Cincinnati 25, Ohio.
Monarch Machine Tool Co., 27 Oak St.,
Sidney, Ohio.
Nebel Machine Tool Co., 3401 Central Park-
way, Cincinnati 25, Ohio.

Rivett Lathe & Grinder, Inc., Brighton, Boston
35, Mass.
Rockford Machine Tool Co., 2500 Kishwaukee
St., Rockford, Ill.
Sheldon Mch. Co., Inc., 4240-4258 N. Knox
Ave., Chicago 41, Ill.
Sidney Machine Tool Co., Sidney, Ohio.
South Bend Lathe Works, Inc., 425 E. Mad-
ison St., South Bend, Ind.
Springfield Mch. Tool Co., Springfield, Ohio.
Western Machine Tool Works, Holland, Mich.
Wickes Brothers, 512 No. Water St., Saginaw,
Mich.

LATHES, Engine, Toolroom

American Tool Works Co., Pearl and Eggleston
Aves., Cincinnati, Ohio.
Atlas Press Co., Kalamazoo, Mich.
Axelson Mfg. Co., 6160 S. Boyle Ave., Los
Angeles 58, Calif.
Barber-Colman Co. (Hendey Mch. Div.), Rock-
ford, Ill.
Carroll-Jamieson Mch. Tool Co., Batavia, Ohio.
Cincinnati Lathe & Tool Co., 3207-3211 Dis-
ney St., Oakley, Cincinnati 9, Ohio.
Cosa Corp., 405 Lexington Ave., New York
17, N. Y.
Hardinge Bros., Inc., 1420 College Ave., El-
mira, N. Y.
Homestrand, Inc., Larchmont, N. Y.
LeBlond, R. K., Mch. Tool Co., Madison and
Edwards Rds., Cincinnati 18, Ohio.
Lodge & Shipley Co., 3055 Colerain Ave.,
Cincinnati 25, Ohio.
Monarch Machine Tool Co., 27 Oak St., Sid-
ney, Ohio.
Nebel Machine Tool Co., 3401 Central Park-
way, Cincinnati 25, Ohio.
Rivett Lathe & Grinder, Inc., Brighton, Boston
35, Mass.
Rockford Machine Tool Co., 2500 Kishwaukee
St., Rockford, Ill.
Sheldon Mch. Co., Inc., 4240-4258 N. Knox
Ave., Chicago 41, Ill.
Sidney Machine Tool Co., Sidney, Ohio.
South Bend Lathe Works, Inc., 425 E. Mad-
ison St., South Bend, Ind.
Springfield Mch. Tool Co., Springfield, Ohio.
Wickes Brothers, 512 No. Water St., Saginaw,
Mich.

LATHES, Gap

Atlas Press Co., Kalamazoo, Mich.
Axelson Mfg. Co., 6160 S. Boyle Ave., Los
Angeles 58, Calif.
Cincinnati Lathe & Tool Co., 3207-3211 Dis-
ney St., Oakley, Cincinnati 9, Ohio.
Gisholt Machine Co., 1245 E. Washington
Ave., Madison 10, Wis.
Homestrand, Inc., Larchmont, N. Y.
LeBlond, R. K., Mch. Tool Co., Madison and
Edwards Rds., Cincinnati 18, Ohio.
Lodge & Shipley Co., 3055 Colerain Ave.,
Cincinnati 25, Ohio.
Nebel Machine Tool Co., 3401 Central Park-
way, Cincinnati 25, Ohio.
Sidney Machine Tool Co., Sidney, Ohio.
Springfield Mch. Tool Co., Springfield, Ohio.

LATHES, Gun

Axelson Mfg. Co., 6160 S. Boyle Ave., Los
Angeles 58, Calif.
Baldwin-Lima-Hamilton Corp., Lima Hamilton
Div., Hamilton, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.
LeBlond, R. K., Mch. Tool Co., Madison and
Edwards Rds., Cincinnati 18, Ohio.
Seneca Falls Mch. Co., Seneca Falls, N. Y.
Springfield Machine Tool Co., Springfield, Ohio.
Wickes Brothers, 512 No. Water St., Saginaw,
Mich.

LATHES, Hollow Spindle

Axelson Mfg. Co., P.O. Box 15335, Vernon
Sta., Los Angeles 58, Calif.
Baldwin-Lima-Hamilton Corp., Lima Hamilton
Div., Hamilton, Ohio.
LeBlond, R. K., Mch. Tool Co., Madison and
Edwards Rds., Cincinnati 18, Ohio.
Lodge & Shipley Co., 3055 Colerain Ave., Cin-
cinnati 25, Ohio.
South Bend Lathe Works, Inc., 425 E. Madison
St., South Bend, Ind.

LATHES, Roll

American Tool Works Co., Cincinnati 2, Ohio.
Baldwin-Lima-Hamilton Corp., Lima Hamilton
Div., Hamilton, Ohio.
Bliss, E. W., Co., Canton, Ohio.
LeBlond, R. K., Mch. Tool Co., Cincinnati 18,
Ohio.
Monarch Mch. Tool Co., Oak St., Sidney, Ohio.

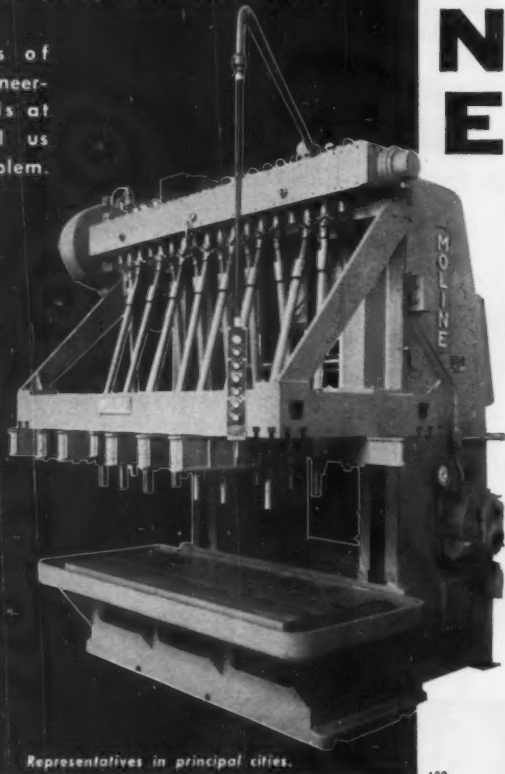
(Continued on page 376)

FOR GREATER . . . PRODUCTION • EFFICIENCY • SAVINGS

Use an individually designed "Hole-Hog" Machine Tool
for such jobs as:

- Multi-Spindle Boring
- Single and Multi-Spindle Honing
- Straight Line Multi-Drilling
- Adjustable Spindle Drilling
- Vertical and Way-Type Fixed Center
Drilling, Boring and Tapping
- Special Multiple Operation Machine Tools

Over 50 years of
Machine Tool Engineer-
ing experience is at
your service. Tell us
your particular problem.



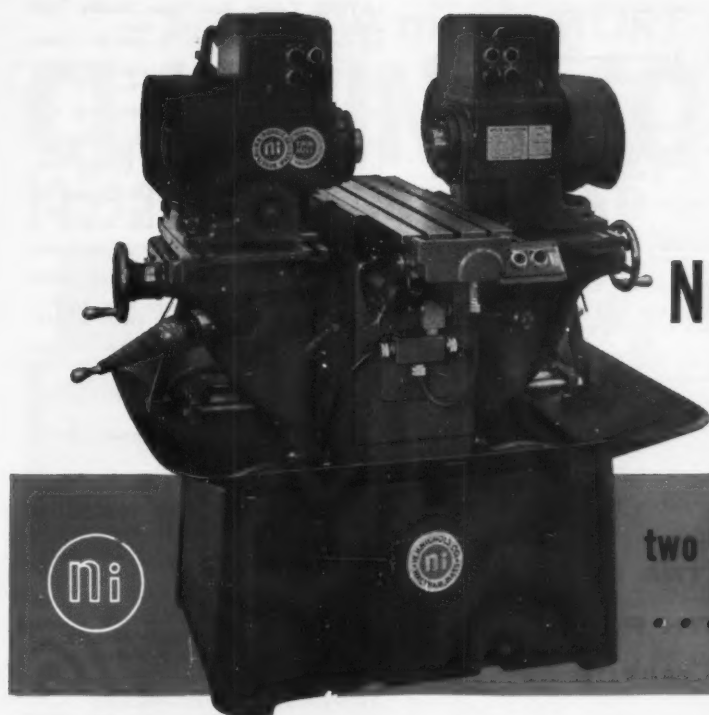
HUG drilling machine
with fourteen spindles
adjustable in a 72 inch
by 24 inch drilling
area. Other sizes
available.



Representatives in principal cities.

MOLINE TOOL COMPANY
100 20TH STREET MOLINE, ILLINOIS

102



NICHOLS TWIN MILL

two heads are better than one
.....for sure!

The Nichols Twin Mill is something new in duplex millers — a precision 2-spindle bed-type miller designed for simultaneous light duty milling of opposite or adjacent surfaces, using **horizontal or vertical spindles**.

The Twin Mill provides unmatched flexibility! It is equally adaptable for long-run or short-run jobs. The two geared milling heads are independent units, with separate 1 HP motor drives, and are quickly adjusted either directly opposed or offset longitudinally, vertically or transversely. Set-up is fast and simple.

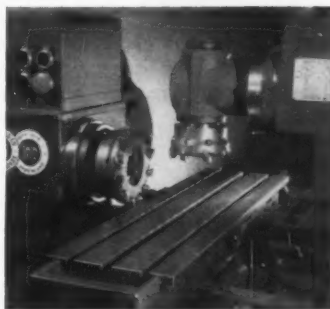
The wide range of spindle speeds from 55 to 2050 R.P.M. allows milling of ferrous or non-ferrous materials with high speed or carbide tipped cutters, producing EXTRA FINE FINISH while maintaining the closest tolerances with ease.

The Twin Mill is completely push-button controlled, arranged for automatic table cycling — with rapid approach, hydraulically controlled variable cutting feed and rapid return. Available with automatic retraction of milling heads, automatic spindle brakes and carefully engineered special features to meet specific applications.

The parts shown are typical of those on which the Twin Mill is cutting costs and boosting production. Investigate the savings it can make for you. For details write to Nichols-Morris Corporation.

CONDENSED SPECIFICATIONS

Table, working surface	8 $\frac{5}{8}$ " x 30"
Table Travel—cutting stroke	11 $\frac{3}{4}$ "
Motors	(two) 1 HP
Spindle Speeds (15)	from 55 to 2050 RPM
Max. height center of spindle above table	11 $\frac{3}{4}$ "
Max. offset of spindles (horizontal)	8 $\frac{1}{2}$ "
Max. distance between spindle noses (across table)	16"
Floor space required	64" x 56"



Manufactured by W. H. Nichols Company, 48 Woerd Avenue, Waltham 54, Mass.

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THE ROBERT E. MORRIS COMPANY

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Connecticut



VALVE GATES



PUMP BODIES



HEX NUTS



GUN PARTS



TURBINE BLADES

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Brown & Sharpe Mfg. Co., 235 Promenade St., Providence 1, R. I.
Gisholt Mch. Co., 1245 E. Washington Ave., Madison 10, Wis.
Hardinge Bros., Inc., 1420 College Ave., Elmira, N. Y.
LeBlond, R. K., Mch. Tool Co., Cincinnati 18, Ohio
Lodge & Shipley Co., Cincinnati 25, Ohio
Monarch Mch. Tool Co., Oak St., Sidney, Ohio
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Seneca Falls Mch. Co., Seneca Falls, N. Y.
Sheldon Mch. Co., 4258 N. Knox Ave., Chicago 41, Ill.
Standard Electrical Tool Co., 2500 River Rd., Cincinnati 4, Ohio

LATHES, Spinning

Cincinnati Milling & Grinding Mches., Inc., 4701 Marburg Ave., Cincinnati 9, Ohio

Lodge & Shipley Co., The, Cincinnati 25, Ohio

LATHES, Toolroom—See Lathes, Engine, Toolroom**LATHES, Turret, Automatic**

Atlas Press Co., Kalamazoo, Mich.
Brown & Sharpe Mfg. Co., Providence, R. I.
Bullard Co., Brewster St., Bridgewater 2, Conn.
Coca Corp., 405 Lexington Ave., New York 17, N. Y.
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
Jones & Lamson Mch. Co., 512 Clinton St., Springfield, Vt.
Nat'l Acme Co., 170 E. 131st St., Cleveland 3, Ohio
New Britain Mch. Co., New Britain-Gridley Div., New Britain, Conn.

LATHES, Turret, Ram Type, Saddle Type

Atlas Press Co., Kalamazoo, Mich.
Bardons & Oliver Inc., Ft. W. 9th St., Cleveland 13, Ohio
Bullard Co., Brewster St., Bridgeport 2, Conn.
Coca Corp., 405 Lexington Ave., New York 17, N. Y.
Delta Power Tool Div., Rockwell Mfg. Co., Pittsburgh, Pa.
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
Hardinge Brothers, Inc., 1420 College Ave., Elmira, N. Y.
Jones & Lamson Mch. Co., 512 Clinton St., Springfield, Vt.
Levin & Son, Inc., Louis, Los Angeles 8, Calif.
New Britain Mch. Co., New Britain-Gridley Div., New Britain, Conn.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Seneca Falls Mch. Co., Seneca Falls, N. Y.
Sheldon Mch. Co., Inc., 4258 N. Knox Ave., Chicago 41, Ill.
South Bend Lathe Wks., South Bend 22, Ind.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 3, Ohio

LATHES, Turret Vertical—See Boring Mills, Vertical**LAYOUT and DRAFTING TOOLS**

Brown & Sharpe Mfg. Co., 235 Promenade St., Providence 1, R. I.
Starrett, L. S., Co., Athol, Mass.

LEVELS

South Bend Lathe Wks., South Bend 22, Ind.
Starrett, The L. S., Co., Athol, Mass.

LIGHTING FIXTURES, Machine

Sun-Lite Mfg. Co., 2555 Bellevue Ave., Detroit 7, Mich.

LIGHTS, Indicator

Dialight Corporation, 60 Stewart Ave., Brooklyn 37, N. Y.
General Electric Co., Schenectady, N. Y.

LIMIT SWITCHES—See Switches, Limit**LUBRICATING OILS and GREASES**

Cities Service Oil Co., 70 Pine St., New York, N. Y.
Houghton, E. F., & Co., 303 W. Lehigh Ave., Philadelphia, Pa.
Lubriplate Div., Fiske Bros. Refining Co., 120 Lockwood St., Newark 5, N. J.
Shell Oil Co., 50 W. 50th St., New York, N. Y.
Standard Oil Co. (Indiana), 910 S. Michigan, Chicago, Ill.
Stuart, D., Oil Co., Ltd., 2739 S. Troy St., Chicago 23, Ill.
Sun Oil Co., 1608 Walnut St., Philadelphia, Pa.
Texas Co., 135 E. 42nd St., New York, N. Y.

LUBRICATING SYSTEMS

Farval Corp., 3249 E. 80th St., Cleveland, Ohio
Gits Bros. Mfg. Co., 1846 S. Kilbourn Ave., Chicago 23, Ill.
Madison-Kipp Corp., Madison, Wis.

MACHINERY, Used and Rebuilt

Eastern Mchry. Co., 1000 Tennessee Ave., Cincinnati, Ohio
Michigan Drill Head Co., Van Dyke, Mich.
Miles Mchry. Co., 2025 E. Genesee Ave., Saginaw, Mich.
Match & Merryweather Mchry. Co., 888 E. 70th St., Cleveland 3, Ohio
Van Keuren Co., Watertown, Mass.
Williams, J. H., & Co., 400 Vulcan St., Buffalo 7, N. Y.

MACHINISTS' SMALL TOOLS

Brown & Sharpe Mfg. Co., 235 Promenade St., Providence 1, R. I.
Niagara Mch. & Tool Wks., 637-697 Northland Ave., Buffalo 11, N. Y.
Starrett, L. S., Co., Athol, Mass.

MANDRELS—See Arbors and Mandrels (Continued on page 378)

EXTRA CAPACITY WITH PRECISION TO MATCH

Large area dies are no problem when you have an L&J No. 50 Series press with its extra capacity. The exceptionally heavy frame provides maximum rigidity which enables the flanged, box-type ram to maintain precision alignment for precision jobs. The large work area will permit you to run a greater variety of work. Its dependability and tooling ease provide a new high in press efficiency.

Available in geared and non-geared models. Air clutch is available. It will pay you to get complete details now.

SPECIFICATIONS

Capacity: Model 50—50 tons, Model 50B—56 tons. Shut Height: 10" to 25". Ram Stroke: 3" to 8". Ram Adjustment: 3". Ram Face: 24" x 12". Bolster Plate: 36" x 24" x 2 1/4". Throat Depth: 12 1/2". Opening Thru Back: 22". Speed: Model 50 Non-geared—100 S.P.M., Geared—50 S.P.M. Model 50B Non-geared—95 S.P.M. Geared—46 S.P.M. Higher speeds with air clutch.

Write for Bulletin L-14

Describes L&J O.B.I. Presses. 23 Models, 14 to 90 tons, geared and non-geared. Also, 20 to 90 ton Double Crank, High Speed, Straight Side Presses.

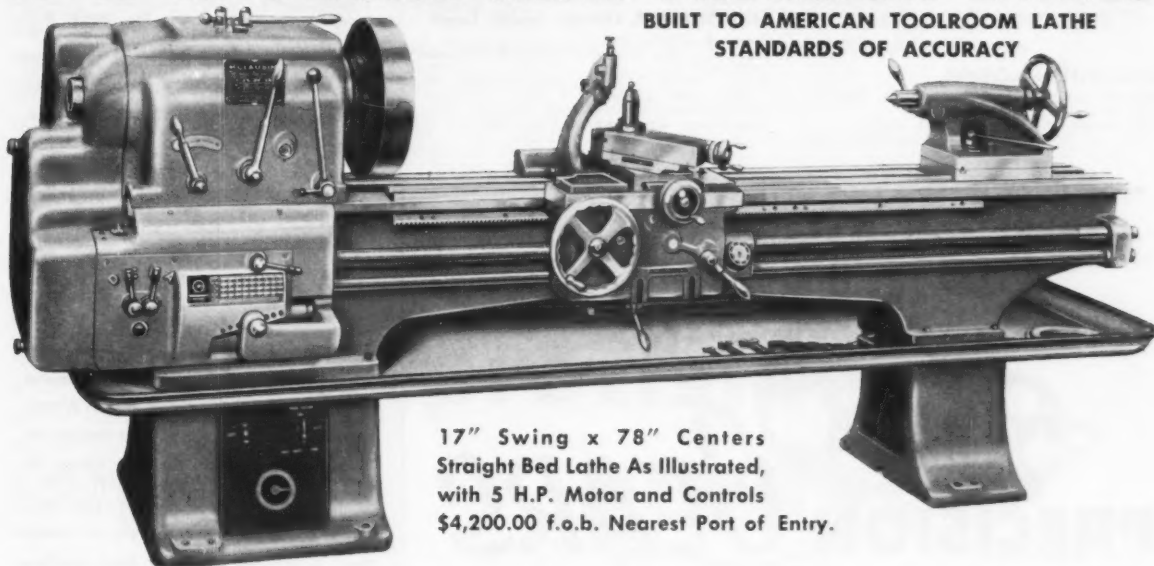
L&J PRESS CORPORATION

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See how much **MORE** you get with **CLAUSING-COLCHESTER** **13"-15"-17" GEARED-HEAD PRECISION LATHES**

BUILT TO AMERICAN TOOLROOM LATHE
STANDARDS OF ACCURACY



17" Swing x 78" Centers
Straight Bed Lathe As Illustrated,
with 5 H.P. Motor and Controls
\$4,200.00 f.o.b. Nearest Port of Entry.

BIG CAPACITY — larger spindle capacities (see chart below). Swing for the gap bed models is 29" for the 17"; 25" for the 15"; and 19" for the 13". Between centers capacities: 78" for the 17" lathe; 30" and 48" for the 15"; and 24" and 36" for the 13". Geared-head drive powered by multiple V-belts.

HEAVY-DUTY CONSTRUCTION — Massive semi-steel beds with elliptical cross ribbing. Precision-ground V and flat ways — hardened ways available. Geared-head and quick-change box run in bath of oil, all gears shaved and hardened. Power feeds taken from separate feed rod, lead screw used only for screw cutting. Note size of spindles and spindle bearings (see chart in panel at right). Note, too, heavy-duty construction of tailstock, and of carriage assembly with double-walled apron.

PRECISION PERFORMANCE — built to American toolroom lathe standards of accuracy. Have GAMET MICRON tapered roller bearings . . . with oil flow

lubrication . . . most advanced and accurate bearings known to industry.

PROMPT DELIVERIES — through your authorized CLAUSING-COLCHESTER dealer.

OUTSTANDING QUALITY and VALUE — built by Europe's largest manufacturer of precision lathes . . . for over 50 years producers of lathes acknowledged the world over to be the finest value and the most accurate in their class! Backed by the coast-to-coast sales and service organization of one of America's leading machine tool manufacturers . . . CLAUSING.

PRICES — 13" cabinet base models, including motor and controls start at \$1875; 15" cabinet base at \$2650; 17" at \$4200. All f.o.b., nearest port of entry. 5 straight bed and 5 gap bed models available.

WRITE FOR ILLUSTRATED LITERATURE

BIG SPINDLE CAPACITIES



CAPACITY	17"	15"	13"
THRU-HOLE	3 1/16"	2 1/16"	1 7/16"
NOSE TAPER			
KEY DRIVE	L-2	L-1	L-0

BIGGER BEARINGS



GAMET MICRON precision taper roller bearings with oil flow lubrication . . . the most advanced and accurate bearings known to industry.

SIZE	17"	15"	13"
FRONT SPINDLE BEARING O.D.	7 1/2"	5 1/2"	4"

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CLAUSING **DIVISION**
ATLAS PRESS COMPANY
11-108 N. PITCHER ST. — KALAMAZOO, MICH.

For more information fill in page number on Inquiry Card, on page 275

MACHINERY, November, 1956—377

MARKING MACHINES and DEVICES

Acromark Co., 9-11 Marrell St., Elizabeth 4, N. J.
Colonial Broach & Machine Co., P. O. Box 37, Harper Sta., Detroit 13, Mich.
Gorton Mch. Co., 1321 Racine St., Racine, Wis.

MATERIAL-HANDLING TRUCKS—See Trucks, Material Handling**MEASURING MACHINES**

Sheffield Corp., 721 Springfield St., Dayton 1, Ohio
Van Keuren Co., Watertown 72, Mass.

MEASURING WIRES, Thread, Spline, Gear

Sheffield Corp., Dayton 1, Ohio
Throuwell Tap & Die Co., 16 Arch St., Greenfield, Mass.
Van Keuren Co., Watertown 72, Mass.

MICROMETER HEADS

Brown & Sharpe Mfg. Co., 235 Promenade St., Providence 1, R. I.
DoALL Co., Des Plaines, Ill.
Starrett, The L. S., Co., Athol, Mass.

MICROMETERS, Outside, Inside, Depth

Brown & Sharpe Mfg. Co., Providence, R. I.
DoALL Co., 254 N. Laurel Ave., Des Plaines, Ill.
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.
Starrett, The L. S., Co., Athol, Mass.
Van Keuren Co., Watertown 72, Mass.

MICROSCOPES, Toolmakers'

DoAll Co., Des Plaines, Ill.
Opto-Metric Tools, Inc., 137 Varick St., New York, N. Y.
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.

MILLING MACHINE ATTACHMENTS

Bridgeport Mches., Inc., 500 Lindley St., Bridgeport 6, Conn.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling & Grinding Mches., Inc., 4701 Marburg Ave., Cincinnati 9, Ohio
G & L and Hypro Div., Giddings & Lewis Mch. Tool Co., Fond du Lac, Wis.
Gorton, George, Mch. Co., 1110 W. 13th St., Racine, Wis.
Greaves Mch. Tool Div., 2011 Eastern Ave., Cincinnati 2, Ohio
Hardinge Bros., Inc., 1420 College Ave., Elmira, N. Y.
Homestrand, Inc., Larchmont, N. Y.
Kearney & Trecker Corp., Milwaukee, Wis.
Sheldon Mch. Co., Inc., 4258 N. Knox Ave., Chicago 41, Ill.
Van Norman Co., 3640 Main St., Springfield 7, Mass.

MILLING MACHINES, Automatic

Cincinnati Milling Machine Co., Cincinnati, Ohio
Consolidated Machine Tool Corp., Rochester, N. Y.
Cross Co., 3250 Bellevue Ave., Detroit 7, Mich.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Jones & Lamson Mch. Co., 160 Clinton St., Kearney & Trecker Corp., Milwaukee, Wis.
Marac Machinery Corp., Yonkers, N. Y.
Milholland, W. K., Machinery Co., 6402 Westfield Blvd., Indianapolis 5, Ind.
Mott & Merryweather Machinery Co., Penton Bldg., Cleveland, Ohio
Pratt & Whitney Co., Inc., West Hartford, Conn.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.

MILLING MACHINES, Bench, Hand

Atlas Press Co., Kalamazoo, Mich.
Hardinge Bros., Inc., 1420 College Ave., Elmira, N. Y.
Nichols-Morris Corp., 76 Mamaroneck Ave., White Plains, N. Y.

MILLING MACHINES, Bed Type, Simplex, Duplex

Brown & Sharpe Mfg. Co., 235 Promenade St., Providence 1, R. I.
Cincinnati Milling & Grinding Mches., Inc., 4701 Marburg Ave., Cincinnati 9, Ohio
Consolidated Mch. Tool Div., Blossom Road, Rochester 10, N. Y.
Espin-Lucas Mch. Works, Front St. and Girard Ave., Philadelphia, Pa.
Kearney & Trecker Corp., Milwaukee, Wis.
Mott & Merryweather Mchry. Co., 888 E. 70th St., Cleveland 3, Ohio
Sundstrand Mch. Tool Co., 2531 - 11th St., Rockford, Ill.
U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.
Van Norman Co., 3640 Main St., Springfield 7, Mass.

MILLING MACHINES, Circular, Continuous

Consolidated Mch. Tool Corp., Rochester, N. Y.
Davis & Thompson Co., 6411 W. Burnham St., Milwaukee 14, Wis.
Espin-Lucas Mch. Works, Front St., and Girard Ave., Philadelphia, Pa.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Kearney & Trecker Corp., Milwaukee, Wis.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

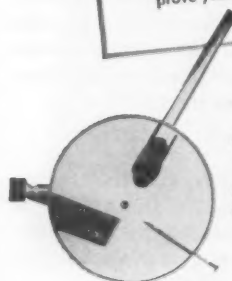


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YOU who use small gears, (to 6" O.D. of the gear blank) can improve the performance of your product, through increased gear precision, without sacrifice of gear production.

YOU who use small, fine pitch, precision gears can increase your gear production without sacrifice of gear accuracy, or improve your gear accuracy without sacrifice of gear production.

The Hamilton Precision Gear Hobber, the hobber with a "reserve of accuracy," regularly holds work spindle and hob spindle runout to less than .0002", workspindle and tailstock spindle alignment to less than .0002", and this workmanship is maintained throughout the machine.

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 Bridgeport Mches., Inc., 500 Lindley St., Bridgeport 6, Conn.
 Cincinnati Milling & Grinding Mches., Inc., 4701 Marburg Ave., Cincinnati 9, Ohio
 Consolidated Mch. Tool Div., Blossom Road, Rochester 10, N. Y.
 Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
 Elox Corp. of Mich., 1830 Stephenson Highway, Royal Oak 3, Mich.
 Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
 G & L and Hypro Div., Giddings & Lewis Mch. Tool Co., Fond du Lac, Wis.
 Gorton, George, Machine Co., 1110 W. 13th St., Racine, Wis.
 Kearney & Trecker Corp., Milwaukee, Wis.
 Russell, Holbrook & Henderson, Inc., 292 Madison Ave., New York 17, N. Y.
 Sundstrand Mch. Tool Co., 2531 - 11th St., Rockford, Ill.

MILLING MACHINES, Knee Type, Horizontal, Plain, Universal

Austin Industrial Corp., 76 Mamaroneck Ave., White Plains, N. Y.
 Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Calif.
 Brown & Sharpe Mfg. Co., Providence, R. I.
 Bullard Co., Bridgeport 6, Conn.
 Cincinnati Milling & Grinding Mches., Inc., 4701 Marburg Ave., Cincinnati 9, Ohio
 Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
 Gorton, Geo., Mch. Co., 1110 W. 13th St., Racine, Wis.
 Greaves Machine Tool Div., 2009 Eastern Ave., Cincinnati, Ohio
 Hardinge Bros., Inc., 1420 College Ave., Elmhurst, N. Y.
 Homestrand, Inc., Larchmont, N. Y.
 Kearney & Trecker Corp., Milwaukee, Wis.
 Sheldon Machine Co., Inc., 4240-4258 N. Knox Ave., Chicago 41, Ill.
 Van Norman Co., 3640 Main St., Springfield 7, Mass.

MILLING MACHINES, Knee Type Rise and Fall

Cincinnati Milling & Grinding Mches., Inc., 4701 Marburg Ave., Cincinnati 9, Ohio
 Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
 Homestrand, Inc., Larchmont, N. Y.
 Kearney & Trecker Corp., Milwaukee, Wis.
 Nichols-Morris Corp., 76 Mamaroneck Ave., White Plains, N. Y.

MILLING MACHINES, Knee Type Ram

Brown & Sharpe Mfg. Co., 235 Promenade St., Providence 1, R. I.
 Gorton Mch. Co., 1321 Racine St., Racine, Wis.
 Kearney & Trecker Corp., Milwaukee, Wis.
 Van Norman Co., 3640 Main St., Springfield 7, Mass.

MILLING MACHINES, Knee Type, Turret

Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
 Gorton Mch. Co., 1321 Racine St., Racine, Wis.

MILLING MACHINES, Knee Type, Vertical

Atlas Press Co., Kalamazoo, Mich.
 Austin Industrial Corp., 76 Mamaroneck Ave., White Plains, N. Y.
 Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Calif.
 Bridgeport Mches., Inc., 500 Lindley St., Bridgeport 6, Conn.
 Brown & Sharpe Mfg. Co., Providence, R. I.
 Cincinnati Milling & Grinding Mches., Inc., 4701 Marburg Ave., Cincinnati 9, Ohio
 Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
 Gorton, Geo., Mch. Co., 1110 W. 13th St., Racine, Wis.
 Homestrand, Inc., Larchmont, N. Y.
 Kearney & Trecker Corp., Milwaukee, Wis.
 Russell, Holbrook & Henderson, Inc., 292 Madison Ave., New York 17, N. Y.
 South Bend Lathe Wks., South Bend 22, Ind.

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Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio
 Consolidated Mch. Tool Div., Blossom Road, Rochester 10, N. Y.
 Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
 Espen-Lucas Mch. Works, Front St. and Girard Ave., Philadelphia, Pa.
 Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
 Gray, G. A., Co., Woodburn Ave. and Penn. R. R., Evanston, Cincinnati, Ohio
 Kearney & Trecker Corp., Milwaukee, Wis.
 Sundstrand Mch. Tool Co., 2531 - 11th St., Rockford, Ill.

MILLING MACHINES, Spar

Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio
 Cincinnati Milling & Grinding Mches., Inc., 4701 Marburg Ave., Cincinnati 9, Ohio
 G & L and Hypro Div., Giddings & Lewis Mch. Tool Co., Fond du Lac, Wis.
 Kearney & Trecker Corp., Milwaukee, Wis.
 Sundstrand Mch. Tool Co., 2531 - 11th St., Rockford, Ill.

MILLING MACHINES, Thread

Coulter Mch. Co., James, Bridgeport 5, Conn.
 Lees-Brodner Co., The, Cleveland 11, Ohio
 Waltham Mch. Wks., Inc., Waltham 54, Mass.

MOLDING MACHINES, Plastic

Baker Bros., Inc., 1000 Post St., Toledo 10, Ohio
 Fellows Gear Shaper Co., 78 River St., Springfield, Vt.
 Hydraulic Press Mfg. Co., Mount Gilead, Ohio
 Lake Erie Engrg. Corp., 470 Woodward Ave., Buffalo 17, N. Y.

MOLYBDENUM

Climax Molybdenum Co., New York, N. Y.
 (Continued on page 380)

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 Super Sensitive
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 Precision
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Are you fighting the never-ending battle of trying to produce exact holes on a drilling machine which, itself, is not built to precision tolerances? You are under no necessity to do so. For the difference in price between the cheapest bench type, small hole drilling machine and the Hamilton Varimatic is reckoned in pennies per day. And the Hamilton Varimatic (holes from .004" to 1/2" in all drillable materials) is super sensitive. Provides speeds, infinitely variable, between 840 R.P.M. and 9300 R.P.M. Is built to precision tolerances, and with the stamming to retain precision.

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AIR engineering at work**REPORT No. 5098B-3**

Multiple Screw Driver assembles 400 carburetors per hour

Assembling carburetors was a slow, one-screw-at-a-time operation until AIR engineering solved the bottleneck. Now one operator uses this 8-spindle automatic Multiple Screw Driver to help turn out more than 6 completed carburetors per minute—400 every hour.

This compact, easy-to-operate Multiple Screw Driver is just one more example of how AIR engineering is helping modern industry solve problems and cut production time and costs.

All the experience of Ingersoll-Rand in speeding up fastening through AIR engineering multiple units is yours for the asking. Whether your operations involve screw-driving or nut running with either hand-held or automatic production line units, Ingersoll-Rand can engineer and build just the unit best suited to your needs.



8-Spindle Multiple Screw Driver
for carburetor assembly.

Drop us a line if you'd like an
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make recommendations on
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General Electric Co., Schenectady, N. Y.
Howell Electric Motors Co., Howell, Mich.
Lincoln Electric Co., Cleveland 17, Ohio
Reliance Electric & Engrg. Co., 1074 Ivanhoe
Rd., Cleveland 10, Ohio

MOTORS, Hydraulic

Barnes, J. S. Corp., Rockford, Ill.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit
32, Mich.
Hydraulic Press Mfg. Div., Mt. Gilead, Ohio
Oilgear Co., 1569 W. Pierce St., Milwaukee,
Wis.
Sundstrand Mch. Tool Co., 2531 - 11th St.,
Rockford, Ill.
Vickers, Inc., Detroit 32, Mich.

MULTIPLE INSPECTION GAGES—See
Gages, Multiple Inspection

**MULTIPLE-STATION MACHINES, Dial
Type**

Avey Drilling Mch. Co., 25 E. 3rd St., Covington,
Ky.
Baker Bros., Inc., 1000 Post St., Toledo 10,
Ohio
Barnes Drill Co., 814 Chestnut St., Rockford,
Ill.
Baush Mch. Tool Co., 15 Wason Ave., Springfield,
Mass.
Bodine Corp., 317 Mt. Grove St., Bridgeport,
Conn.
Cross Co., 3250 Bellevue, Detroit 7, Mich.
Ettco Tool Co., Inc., 594 Johnson Ave.,
Brooklyn 37, N. Y.
Federal Prod. Corp., 1144 Eddy St., Providence
1, R. I.
Greenlee Bros. & Co., 2136 - 12th St., Rock-
ford, Ill.
Kingsbury Mch. Tool Corp., Keene, N. H.
La Salle Tool, Inc., 3840 E. Outer Drive,
Detroit 34, Mich.
Michigan Drill Head Co., Van Dyke, Mich.
Milholland, W. K., Mchry. Co., Inc., Indian-
apolis 20, Ind.
Modern Industrial Engrg. Co., 14230 Birwood
Ave., Detroit 38, Mich.
National Automatic Tool Co., S. 7th N. Sts.,
Richmond, Ind.
Snyder Tool & Engrg. Co., 3400 E. Lafayette
Ave., Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 - 11th St.,
Rockford, Ill.
Verson Allsteel Press Co., 9309 S. Kenwood
Ave., Chicago 19, Ill.

**MULTIPLE-STATION MACHINES,
Transfer Type**

Avey Drilling Mch. Co., 25 E. 3rd St., Covington,
Ky.
Baker Bros., Inc., 1000 Post St., Toledo 10,
Ohio
Barnes Drill Co., 814 Chestnut St., Rockford,
Ill.
Baush Mch. Tool Co., 15 Wason Ave., Springfield,
Mass.
Buhr Mch. Tool Co., 839 Green St., Ann Arbor
Mich.
Bullard Co., Bridgeport 6, Conn.
Cincinnati Milling Mch. Co., Cincinnati 9,
Ohio
Clearing Mch. Corp., 6499 W. 65th St., Chi-
cago 38, Ill.
Davis & Thompson Co., 4460 N. 124th St.,
Milwaukee 10, Wis.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit
32, Mich.
Greenfield Bros. & Co., 2136 - 12th St., Rock-
ford, Ill.
Heald Machine Co., 10 New Bond St., Worcester
6, Mass.
Kearney & Trecker Corp., Milwaukee, Wis.
La Salle Tool, Inc., 3840 E. Outer Drive, De-
troit 34, Mich.
Michigan Drill Head Co., Van Dyke, Mich.
Milholland, W. K., Mchry. Co., Inc., Indian-
apolis 20, Ind.
Modern Industrial Engrg. Co., 14230 Birwood
Ave., Detroit 38, Mich.
Moline Tool Co., 102-20th St., Moline, Ill.
National Automatic Tool Co., S. 7th N. Sts.,
Richmond, Ind.
Norton Co., 1 New Bond St., Worcester 6,
Mass.
Snyder Tool & Engrg. Co., 3400 E. Lafayette
Ave., Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 - 11th St.,
Rockford, Ill.
Verson Allsteel Press Co., 9399 S. Kenwood
Ave., Chicago 19, Ill.

NAMEPLATES

Acromark Co., 9-11 Morrell St., Elizabeth, N. J.

NIBBLING MACHINES

Thor Power Tool Co., 175 N. State St., Aurora, Ill.
Wales-Strippet Corp., North Tonawanda, N. Y.

NICKEL AND NICKEL ALLOYS

Crucible Steel Co. of America, Henry W. Oliver Bldg., Mellon Square, Pittsburgh 22, Pa.

NUMBERING MACHINES

Acromark Co., 9-11 Morrell St., Elizabeth, N. J.

NUT SETTERS—See Screwdrivers, etc.

NUTS—See Bolt, Nuts and Screws

OIL EXTRACTORS

De Laval Separator Co., Poughkeepsie, N. Y.

OIL GROOVERS

Wicaco Machine Corp., Wayne Junction, Philadelphia, Pa.

OILERS AND LUBRICATORS

Gits Bros. Mfg. Co., 1858 S. Kilbourn Ave., Chicago, Ill.
Madison-Kipp Corp., Madison, Wis.
Wicaco Mch. Corp., Philadelphia, Pa.

OILS, CUTTING SOLUBLE—See Cutting and Grinding Fluids

OILS, Lubricating—See Lubricating Oils and Greases

OILS, Quenching and Tempering

Cities Service Oil Co., 70 Pine St., New York, N. Y.
Houghton & Co., E. F., 303 W. Lehigh Ave., Philadelphia, Pa.
Shell Oil Co., 50 W. 50th St., New York, N. Y.
Sinclair Refining Co., 600 - 5th Ave., New York, N. Y.
Standard Oil Co., (Indiana), 910 S. Michigan Ave., Chicago 80, Ill.
Stuart Oil Co., Ltd., D. A., 2739 S. Troy St., Chicago, Ill.
Sun Oil Co., 1608 Walnut St., Philadelphia 3, Pa.

OPTICAL FLATS

Crane Packing Co., 1800 Cuyler Ave., Chicago, Ill.
DoAll Co., Des Plaines, Ill.
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.
Van Keuren Co., Watertown 72, Mass.

ORDNANCE MACHINES, Special

Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio.
Michigan Drill Head Co., Detroit 34, Mich.
Miholland, W. K. Machinery Co., 6402 Westfield Blvd., Indianapolis 5, Ind.
Rehnberg-Jacobson Mfg. Co., 2135 Kishwaukee St., Rockford, Ill.
Version Allsteel Press Co., 93rd St., & S. Kenwood Ave., Chicago, Ill.

PACKING, Leather, Metal, Rubber, Asbestos, Etc.

Crane Packing Co., 1800 Cuyler Ave., Chicago, Ill.
Garlock Packing Co., Palmyra, N. Y.
Houghton & Co., E. F., 303 W. Lehigh Ave., Philadelphia, Pa.

(Continued on page 382)



New I-R Torque Control Impacttools prove value on auto assembly line

A leading auto manufacturer reports greatly improved *product quality* on 3 auto and truck assembly line operations where Ingersoll-Rand Torsion Bar Torque Control Impacttools have been used for 6 months.

A safety hazard is eliminated on one operation, where these new Impacttools have made torque control possible for the first time. The photo above shows the I-R Size 5040T Torque Control Impacttool securing the steering gear assembly to the truck frame.

Other major benefits include time saving, because these Impacttools operate at full power and speed until they automatically shut off when pre-set torque is reached . . . and elimination of the need for hand *torquing* on many nut running jobs.



Size 5040T 2 Torsion bars available with max. torques of 60 and 90 ft. lbs.

Write for the complete story on this latest I-R development!

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B-346

SKINNER +GF+ WORK DRIVERS

*the best
for turning
on centers!*

Used and recommended by leading machine tool builders at the Chicago Show

They're fast, powerful — the ideal means for driving smooth or rough bars and forgings located on centers! Jaws are easily reversed to accommodate direction of spindle rotation. Five sizes handle work from 1/4" to 8 1/16" diameter.

- 1/2 turn does the clamping — no wrenches needed
- Each size has wide clamping range • Cuts clamping and unclamping time • Clamps out-of-round work evenly
- Clamping force always matches cutting pressure.

Write Skinner or your Skinner distributor for folder.

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THE **SKINNER**
CHUCK COMPANY
206 Edgewood Ave., New Britain, Conn.



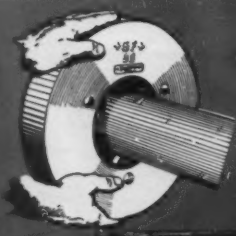
STYLE AND SIZES FOR ALL MACHINES ON WHICH THREADS ARE CUT

This die head is unique

THERE IS NO OTHER LIKE IT

It cuts threads with insert chasers. These are, in reality, small sections of the business end of large and expensive chasers, but with this important difference: *their cost is so low they can be even thrown away when dull.* For example, for less than \$45 you can get a dozen sets of insert chasers, each set ground ready to go. Change now to insert chaser die heads and watch your performance improve. "UNIFIED AND AMERICAN SCREW THREAD DIGEST" sent free on request.

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PAINT MASKING EQUIPMENT

Conforming Matrix Corp., Toledo, Ohio

PAINTING EQUIPMENT, Spray—See Spraying Equipment, Metal

PARALLELS

Brown & Sharpe Mfg. Co., Providence, R. I.
DoAll Co., Des Plaines, Ill.
Starrett, The L. S. Co., Athol, Mass.
Walker, O. S. Co., Inc., Worcester Mass.

PATTERNS, Wood and Metal

Mummert-Dixon Co., Hanover, Pa.

PILLOW BLOCKS

Boston Gear Works, 3200 Main St., North Quincy 71, Mass.
Norma-Hoffman Bearings Corp., Stamford, Conn.
Standard Pressed Steel Co., Jenkintown, Pa.

PIPE, Steel, Stainless, etc.

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Carpenter Steel Co., 105 W. Bern St., Reading, Pa.
Crucible Steel Co. of America, Henry W. Oliver Bldg., Mellon Square, Pittsburgh 22, Pa.
Ryerson, Joseph T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
United States Steel Corp., National Tube Co., Div., 436 7th Ave., Pittsburgh, Pa.

PIPE AND TUBING MILLS, Electric-weld

Yoder Co., 5504 Walworth Ave., Cleveland 2, Ohio

PIPE AND TUBING, Brass and Copper

American Brass Co., 25 Broadway, New York, N. Y.
Mueller Brass Co., 1925 Lapeer Ave., Port Huron, Mich.
Revere Copper & Brass, Inc., 230 Park Ave., New York 17, N. Y.

PIPE THREADING AND CUTTING MACHINES

Davis & Thompson Co., 4460 N. 124th St., Milwaukee 10, Wis.
Landis Machine Co., Inc., Waynesboro, Pa.
Sheffield Corp., Dayton 1, Ohio

PLANER JACKS—See Set-up Equipment

PLANERS, Double Housing and Openside

Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio
Consolidated Mch. Tool Div., Rochester, N. Y.
Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Gray, G. A., Co., 3611 Woodburn Ave., Cincinnati, Ohio
Rockford Machine Tool Co., 2500 Kishwaukee St., Rockford, Ill.

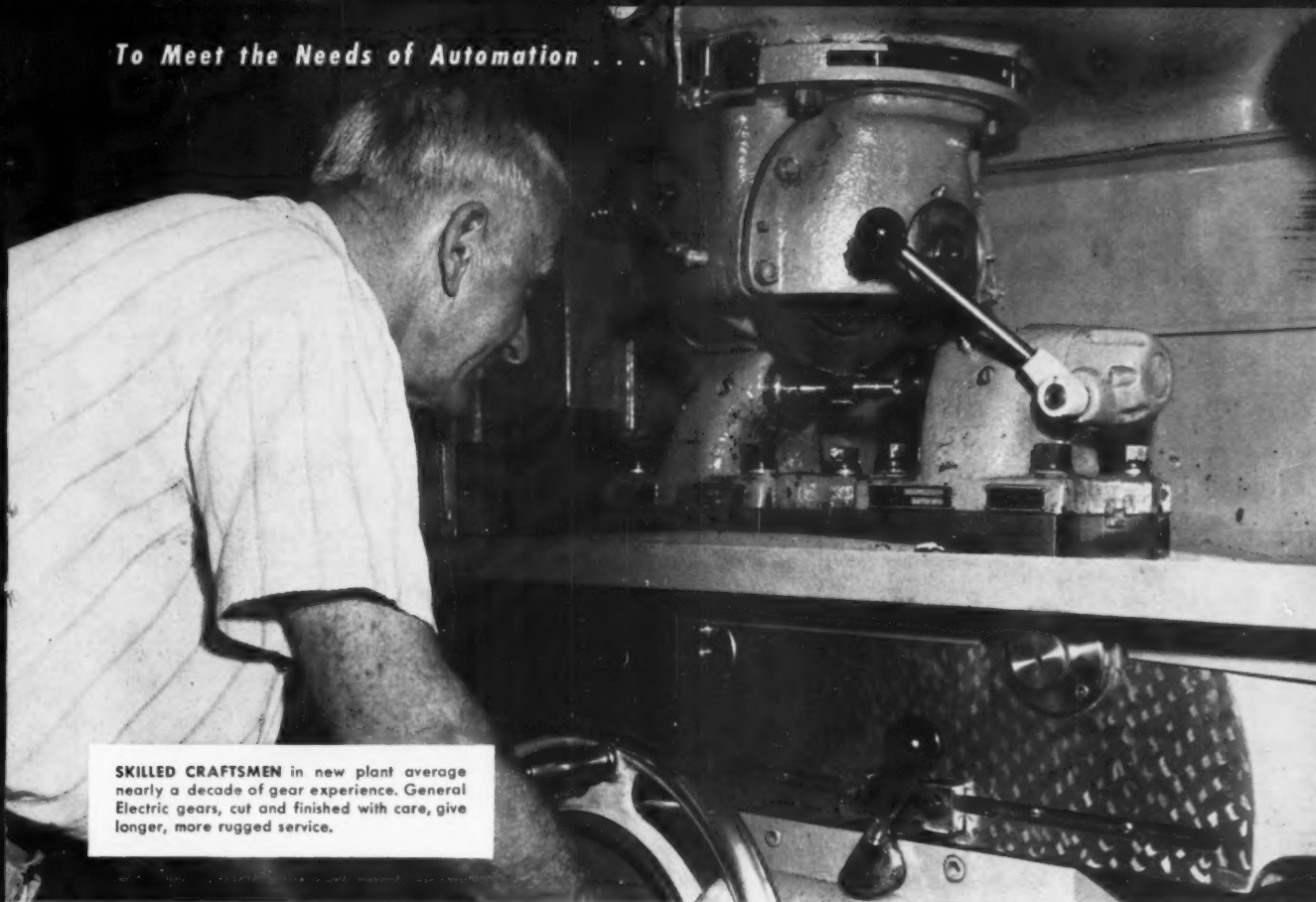
PLASTICS AND PLASTIC PRODUCTS

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Dow Chemical Co., Midland, Mich.
Eastman Kodak Co., 343 State St., Rochester 4, N. Y.
Garlock Packing Co., Palmyra, N. Y.
Gisholt Mch. Co., Madison, Wis.
U. S. Steel Corp., Nat'l Tube Div., Pittsburgh, Pa.

PRESS BRAKES—See Brakes, Presses and Bending

(Continued on page 384)

To Meet the Needs of Automation . . .



SKILLED CRAFTSMEN in new plant average nearly a decade of gear experience. General Electric gears, cut and finished with care, give longer, more rugged service.

At General Electric's **NEW Gear Motor and Transmission Components Department** . . .

3618 man-years of manufacturing know-how assure fast service on low-speed drives

To meet the increased demand for low-speed drives, General Electric's new decentralized Gear Motor and Transmission Components Department will be devoted solely to the design and manufacture of mechanical power transmissions.

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CONTINUOUS TESTING provides data for quality control, new designs and developments. Here, an involute measuring instrument records wear, under simulated tortuous conditions, to nearest ten-thousandths of an inch.

●**Complete Line Available**—General Electric offers a complete line of gear-motors—induction, synchronous, wound rotor, d-c gear-motors—in all types and enclosures, from 1/100 to 200 hp. The new department will also give you rapid service on special needs such as adjustable speed, braking, special mounting or special insulation.

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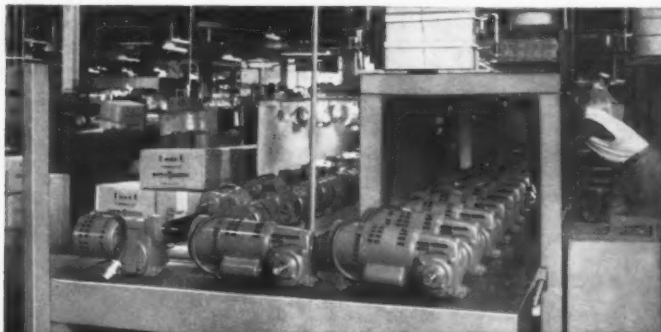
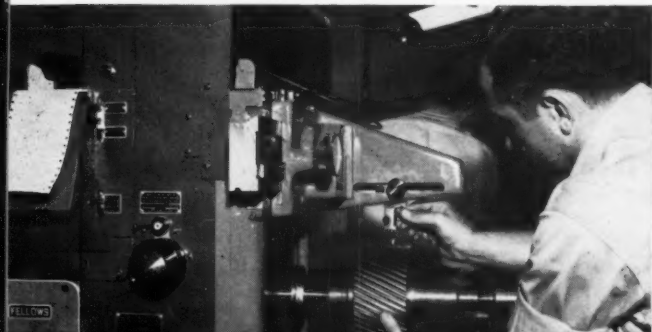
readily adaptable for the production of specials built to your specifications.

●**For More Information**—Write for bulletin GEA-6027, Section 851-2, Schenectady, N. Y., or contact your G-E Apparatus Sales Office or gear-motor supplier. Gear Motor and Transmission Components Department, General Electric Co., Paterson, N. J.

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WITH A HANNIFIN AIR PRESS

It's the ideal press for that occasional pressing job. These presses operate off ordinary shop air supply. They're fast and safe. Over 30 models to choose from...many for either bench or floor mounting. Capacities from 1/2 to 18 tons. Daylight to 46 inches...reach to 12 inches. Prompt delivery.

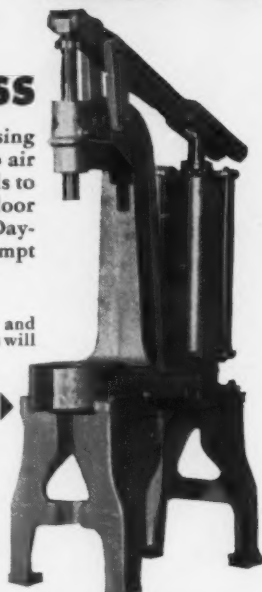


WRITE. Complete information and prices on Hannifin Air Presses will be sent on request.

6 Tons (Model B-2) One of more than 30 models. Press with base, \$519.

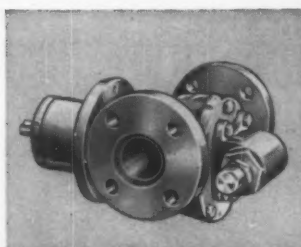
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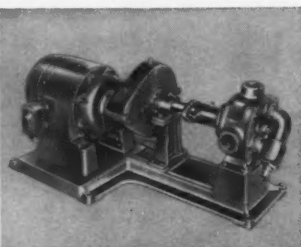


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Baldwin-Lima-Hamilton Corp., Eddystone Div., Philadelphia 42, Pa.
Dake Corp., 604 Seventh St., Grand Haven, Mich.
duMont Corp., Greenfield, Mass.
Farquhar, A. B., Div. Oliver Corp., York, Pa.
Hannifin Corp., 501 S. Wolf Rd., Des Plaines, Ill.
Logansport Machine Co., Inc., 810 Center Ave., Logansport, Ind.
Threadwell Tap & Die Co., Greenfield, Mass.
Tomkins-Johnson Co., 614 No. Mechanic St., Jackson, Mich.
Wilson, K. R., Inc., 211 Mill St., Arcade, N. Y.

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Colonial Broach & Machine Co., P. O. Box 37, Harper Sta., Detroit 13, Mich.
Dake Corp., 604 Seventh St., Grand Haven, Mich.
Farquhar, A. B., Div. Oliver Corp., York, Pa.
Federal Press Co., Elkhart, Ind.
Ferracute Machine Co., Bridgeton, N. J.
Lake Erie Engrg. Co., Kenmore Station, Buffalo, N. Y.
Lapointe Machine Tool Co., 34 Tower St., Hudson, Mass.

PRESSES, Extrusion

Bliss Co., E. W., 1375 Raff Rd., S. W., Canton, Ohio
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Erie Foundry Co., Erie, Pa.
Farquhar, A. B., Div. Oliver Corp., York, Pa.
Federal Press Co., Elkhart, Ind.
Hydraulic Press Mfg. Co., Mount Gilead, Ohio
Lake Erie Engrg. Co., Kenmore Station, Buffalo, N. Y.
Verson Allsteel Press Co., 93rd St., & S. Kenwood Ave., Chicago, Ill.

PRESSES, Foot

Acromark Co., 9-11 Morrell St., Elizabeth, N. J.
Bliss Co., E. W., 1375 Raff Rd., S. W., Canton, Ohio
Ferracute Machine Co., Bridgeton, N. J.
Niagara Machine & Tool Works, 683 Northland Ave., Buffalo, N. Y.

PRESSES, Forging

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Baldwin-Lima-Hamilton Corp., Eddystone Div., Philadelphia 42, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Bliss Co., E. W., 1375 Raff Rd., S. W., Canton, Ohio
Clearing Mch. Corp., Div. U. S. Industries, Inc., 6499 W. 65th St., Chicago, Ill.
Cleveland Punch & Shear Works Co., 3917 St. Clair Ave., N. E., Cleveland, Ohio
Dake Corp., 604 Seventh St., Grand Haven, Mich.
Erie Foundry Co., Erie, Pa.
Farquhar, A. B., Div. Oliver Corp., York, Pa.
Ferracute Machine Co., Bridgeton, N. J.
Hydraulic Press Mfg. Co., Mount Gilead, Ohio
Lake Erie Engrg. Co., Kenmore Station, Buffalo, N. Y.
Niagara Machine & Tool Works, 683 Northland Ave., Buffalo, N. Y.
Verson Allsteel Press Co., 93rd St., and S. Kenwood Ave., Chicago, Ill.
Wilson, K. R., Inc., 211 Mill St., Arcade, N. Y.

PRESSES, Hydraulic

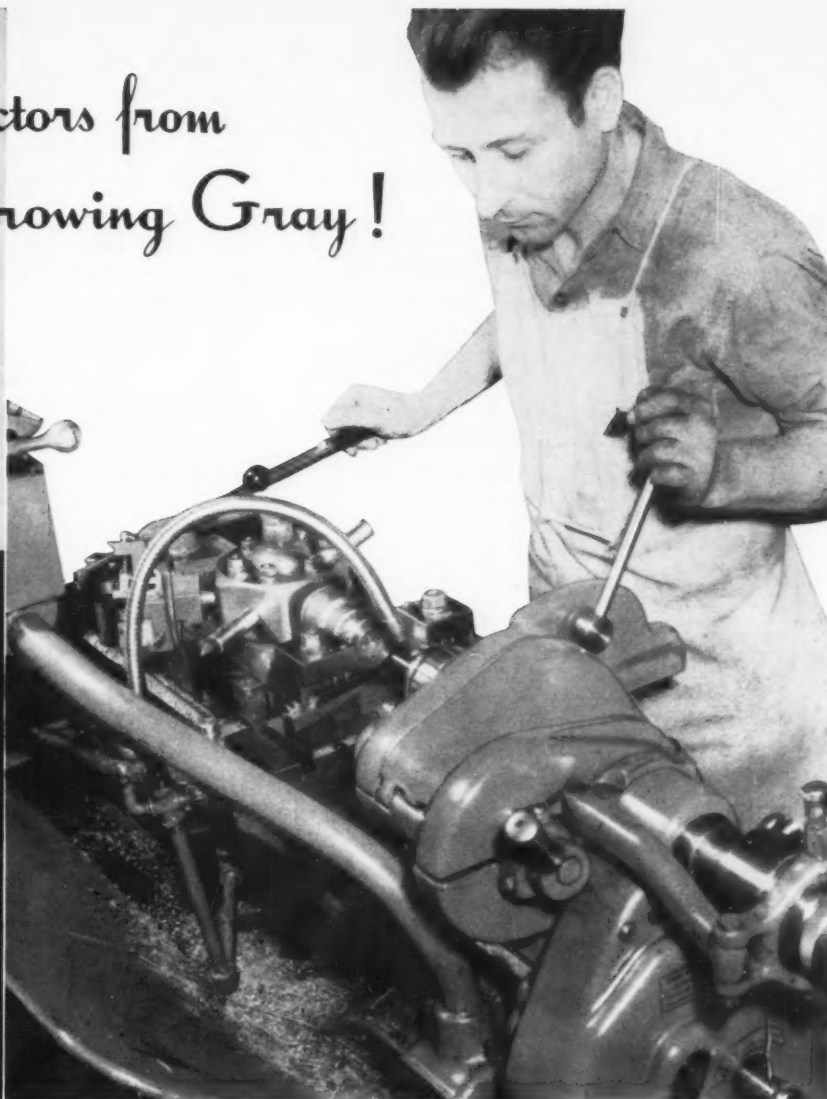
American Broach & Mch. Co., Ann Arbor, Mich.
Anderson Bros. Mfg. Co., 1910 Kishwaukee St., Rockford, Ill.
Baldwin-Lima-Hamilton Corp., Eddystone Div., Philadelphia 42, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
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(Continued on page 386)

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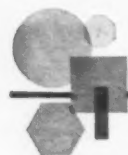
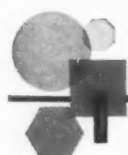
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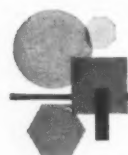
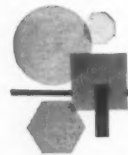
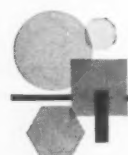
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 Hannifin Corp., 501 S. Wolf Rd., Des Plaines, Ill.
 Hydraulic Press Mfg. Co., Mount Gilead, Ohio
 Lake Erie Engrg. Corp., Kenmore Station, Buffalo, N. Y.
 Lapointe Machine Tool Co., 34 Tower St., Hudson, Mass.
 Niagara Machine & Tool Works, 683 Northland Ave., Chicago, Ill.
 Wilson, K. R., Inc., 211 Mill St., Arcade, N. Y.

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 Dake Corp., 604 Seventh St., Grand Haven Mich.
 Ferracute Machine Co., Bridgeton, N. J.
 Niagara Machine & Tool Works, 683 Northland Ave., Buffalo, N. Y.

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 Baldwin-Lima-Hamilton Corp., Lima-Hamilton Div., Hamilton, Ohio
 Bath, Cyril Co., Aurora & Solon Road, Solon, Ohio
 Bliss Co., E. W., 1375 Raff Rd., S. W., Canton, Ohio
 Chambersburg Engrg. Co., Chambersburg, Pa.
 Cincinnati Milling Machine Co., Process Machinery Div., Cincinnati 9, Ohio
 Cincinnati Shaper Co., Elam and Garrard Aves., Cincinnati, Ohio
 Cleaning Mch. Corp., Div. U. S. Industries, Inc., 6499 W. 65th St., Chicago, Ill.
 Cleveland Crane & Engrg. Co., Wickliffe, Ohio
 Cleveland Punch & Shear Works Co., 3917 St. Clair Ave., N. E., Cleveland, Ohio
 Consolidated Mch. Tool Corp., Rochester, N. Y.
 Dake Corp., 604 Seventh St., Grand Haven, Mich.
 Danly Machine Specialties, Inc., 2107 S. 52nd Ave., Chicago 50, Ill.
 Dreis & Krump Mfg. Co., 7416 Loomis Blvd., Chicago 50, Ill.
 Erie Foundry Co., Erie, Pa.
 Espen-Lucas Machine Works, Front St., and Girard Ave., Philadelphia, Pa.
 Farquhar, A. B., Div. Oliver Corp., York, Pa.
 Federal Machine & Welder Co., Overland Ave., Warren, Ohio
 Federal Press Co., Elkhart, Ind.
 Ferracute Machine Co., Bridgeton, N. J.
 Hydraulic Press Mfg. Co., Mount Gilead, Ohio
 Johnson Machine & Press Corp., Elkhart, Ind.
 L & J Press Corp., Elkhart, Ind.
 Lake Erie Engrg. Corp., Kenmore Station, Buffalo, N. Y.
 Minster Machine Co., Minster, Ohio
 Niagara Machine & Tool Works, 683 Northland Ave., Buffalo, N. Y.
 Verson Allsteel Press Co., 93rd and S. Kenwood Ave., Chicago, Ill.
 Wales-Stripper Corp., North Tonawanda, N. Y.
 Wilson, K. R., Inc., 211 Mill St., Arcade, N. Y.

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 Chambersburg Engrg. Co., Chambersburg, Pa.
 Colonial Broach & Machine Co., P. O. Box 37, Harper Sta., Detroit 13, Mich.
 Consolidated Mch. Tool Corp., Rochester, N. Y.
 Dake Corp., 604 Seventh St., Grand Haven, Mich.
 Erie Foundry Co., Erie, Pa.
 Farquhar, A. B., Div. Oliver Corp., York, Pa.
 Hannifin Corp., 501 S. Wolf Rd., Des Plaines, Ill.
 Hydraulic Press Mfg. Co., Mount Gilead, Ohio
 Lake Erie Engrg. Corp., 470 Woodward Ave., Buffalo, N. Y.

(Continued on page 388)

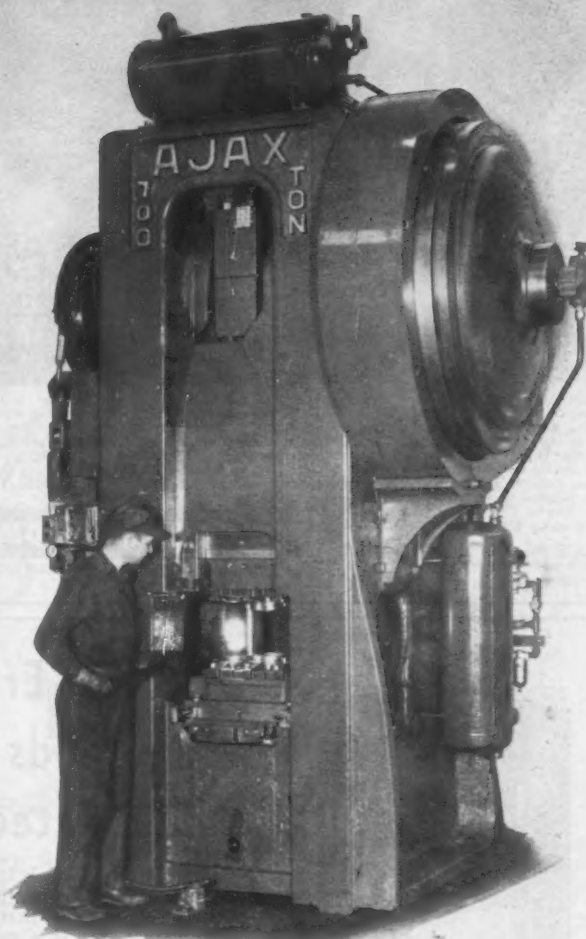
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The progressive forging operations necessary for forming this blank are shown below.

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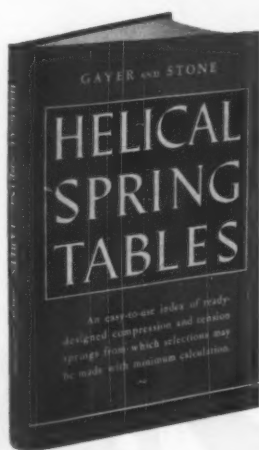
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Wilson, K. R., Inc., 211 Mill St., Arcade, N. Y.

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Brown & Sharpe Mfg. Co., Providence, R. I.
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Gray-Mills Co., 3705 N. Lincoln Ave., Evanston, Ill.
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Hydraulic Press Mfg. Div., Mount Gilead, Ohio
Oilgear Co., 1569 W. Pierce St., Milwaukee, Wis.
Sundstrand Machine Tool Co., 2531 11th St., Rockford, Ill.
Vickers Incorporated, Division of Sperry Rand Corp., 1402 Oakman Blvd., Detroit, Mich.
Viking Pump Co., Cedar Falls, Iowa
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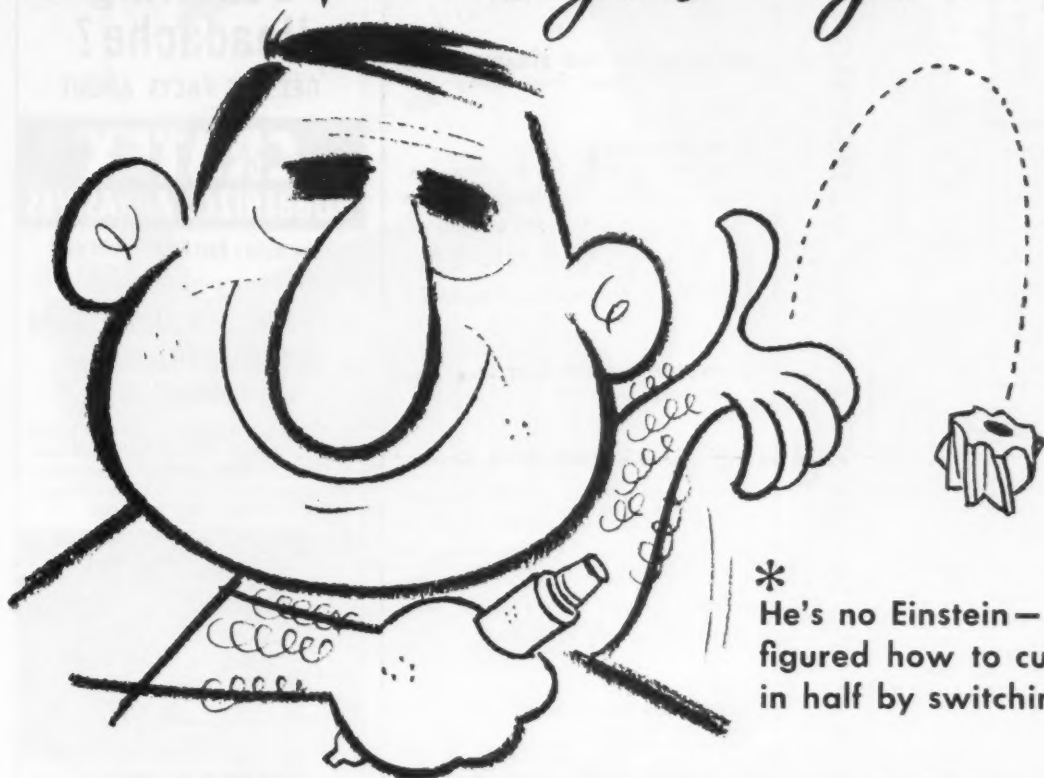
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Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
Grant Mfg. & Mch. Co., 90 Silliman Ave., Bridgeport 5, Conn.
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(Continued on page 390)

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DoALL Co., 254 Laurel Ave., Des Plaines, Ill.
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Match & Merryweather Mch. Co., 888 E. 70th St., Cleveland 3, Ohio
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Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.

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SAWING MACHINES, Band

Armstrong-Blum Mfg. Co., 5700 W. Bloomingdale Ave., Chicago, Ill.
Delta Power Tool Div., Rockwell Mfg. Co., Pittsburgh, Pa.
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SAWING MACHINES, Circular Blade

Consolidated Mch. Tool Div., Blossom Road, Rochester 10, N. Y.
Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa.
DoALL Co., 254 Laurel Ave., Des Plaines, Ill.
Espin-Lucas Machine Works, Front St. and Girard Ave., Philadelphia, Pa.
Match & Merryweather Mch. Co., Penton Bldg., Cleveland, Ohio

SAWING MACHINES, Power Hack

Armstrong-Blum Mfg. Co., 5700 W. Bloomingdale Ave., Chicago, Ill.
Chicago Pneumatic Tool Co., New York 17, N. Y.
Homstrand, Inc., Larchmont, N. Y.
Thor Power Tool Co., 175 N. State St., Aurora, Ill.

SAWS, Screw-slotting—See Cutters, Milling

(Continued on page 392)

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Exceptionally superior and unparalleled for:

**DEBURRING, SMOOTHING, CLEANING
and POLISHING operations**
after dimensional shaping

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Hard and Soft METALS
and other Materials

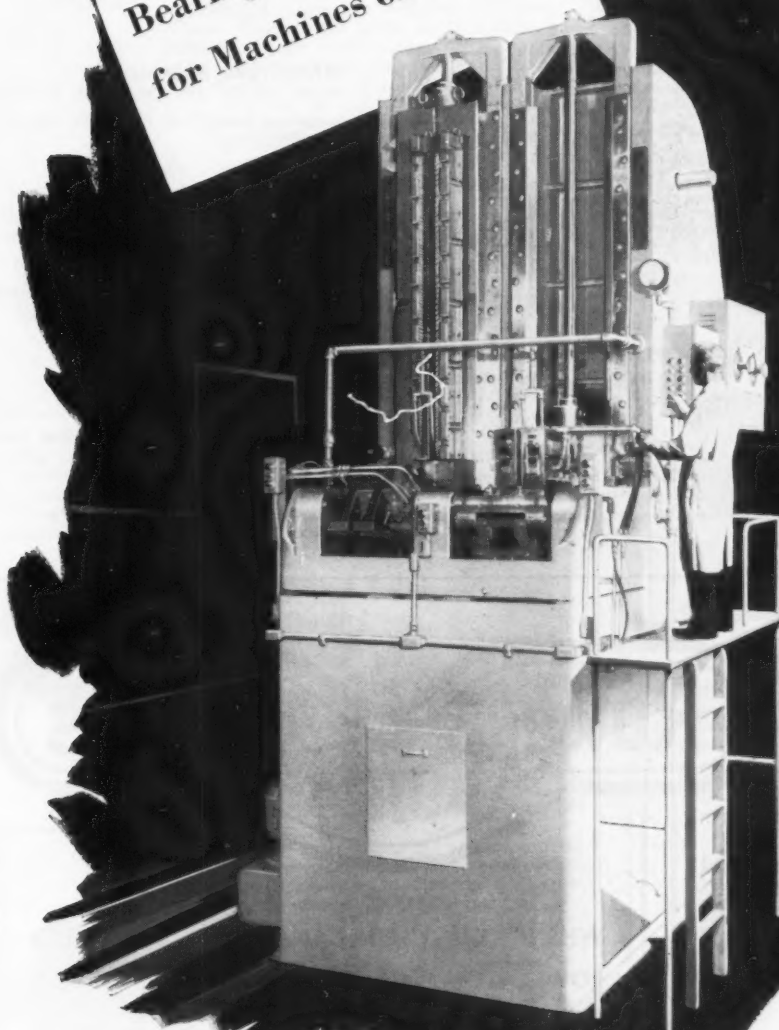
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For more information fill in page number on Inquiry Card, on page 275

MACHINERY, November, 1956—391

SCALES

Hydroway Scales, Inc., 20618 W. Eight Mile Rd., Detroit, Mich.

SCREW DRIVERS, STUD AND NUT SETTERS, Power

Bodine Corp., 317 Mt. Grove St., Bridgeport 5, Conn.
Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
Consolidated Mch. Tool Div., Blossom Road, Rochester 10, N. Y.
Cross Co., 3250 Bellevue, Detroit 7, Mich.
Errington Mech. Lab., Inc., 24 Norwood Ave., Staten Island 4, N. Y.
Ingersoll-Rand Co., 11 Broadway, New York 4, N. Y.
Saully-Jones & Co., 1906 S. Rockwell St., Chicago 8, Ill.
Thor Power Tool Co., Aurora, Illinois
Williams & Co., J. H., 400 Vulcan St., Buffalo 7, N. Y.

SCREW MACHINES, Hand—See Lathes, Turret, Ram-type, Saddle-type**SCREW MACHINES, Single-Spindle Automatic**

Brown & Sharpe Mfg. Co., Providence, R. I.
Cleveland Automatic Machine Co., 4932 Beech St., Cincinnati 12, Ohio
Cone Automatic Mch. Co., Inc., Windsor, Vt.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.

Gear Grinding Mch. Co., 3901 Christopher St., Detroit 11, Mich.
Gisholt Mch. Co., 1245 E. Washington Ave., Madison 10, Wis.
Gorton, George, Mch. Co., 1110 W. 13th St., Racine Wis.
National Acme Co., 170 E. 131st St., Cleveland, Ohio
New Britain Mch. Co., New Britain-Gridley Mch. Div., New Britain, Conn.
Russell, Holbrook & Henderson, Inc., 292 Madison Ave., N. Y. 17, N. Y.

SCREW MACHINES, Multiple-Spindle Automatic

Cone Automatic Mch. Co., Inc., Windsor, Vt.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Greenlee Bros. & Co., 2136 12th St., Rockford, Ill.
National Acme Co., 170 E. 131st St., Cleveland, Ohio
New Britain Mch. Co., New Britain-Gridley Mch. Div., New Britain, Conn.
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.
Warner & Swasey, 6701 Carnegie Ave., Cleveland 3, Ohio

SCREW PLATES

Greenfield Tap & Die Corp., Greenfield, Mass.

SCREWS, Cap, Set, Self-tapping, etc.—

See Bolts, Nuts and Screws
Parker Kalon Div., Clifton, N. J.

SEALS AND RETAINERS, Oil or Grease

American Felt Co., Glenville, Conn.
Crane Packing Co., 1800 Cuyler Ave., Chicago, Ill.
Gits Bros. Mfg. Co., 1858 S. Kilbourn Ave., Chicago, Illinois
Garlock Packing Co., Palmyra, N. Y.

SEPARATORS, Centrifugal

DeLaval Separator Co., Poughkeepsie, N. Y.

SEPARATORS, Magnetic

Barnes Drill Co., 814 Chestnut St., Rockford, Ill.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

SET-UP EQUIPMENT

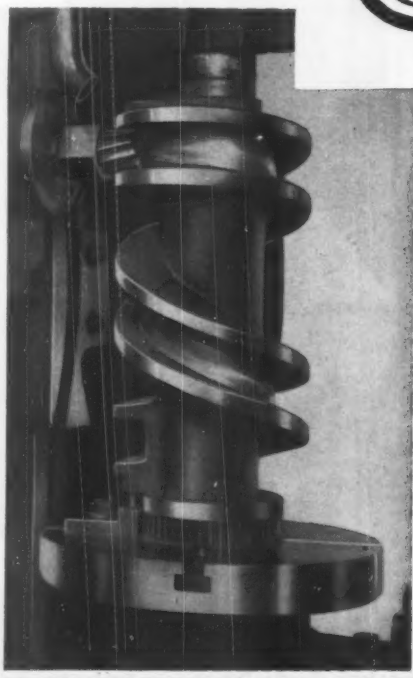
Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Challenge Mchry. Co., Grand Haven, Mich.
Starrett, The L. S., Co., Athol, Mass.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

SHAFTS

Cumberland Steel Co., 101 Williams St., Cumberland, Md.
National Forge & Ordnance Co., Irvine, Warren County, Pa.
Thomson Ind., Inc., Manhasset, N. Y.

(Continued on page 394)

Two revolution Index Cam



Rowbottom for Cams

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Rowbottom's specialized cam production service is available to serve as your "Cam Department" . . . eliminating the need for you to invest in cam manufacturing machines. Every phase of cam making is offered by Rowbottom, from design to manufacture. All types in any quantity can be handled with speed, accuracy and at low cost. It will pay you to investigate.

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Send us your drawings and specifications for cost estimates.

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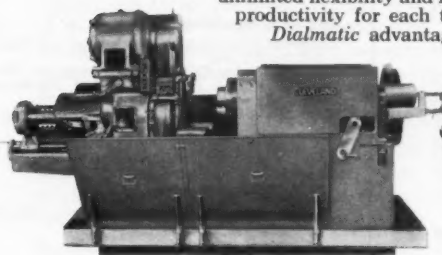
Rowbottom also builds Cam Milling and Cam Grinding Machines for producing all types of cams. Illustrated literature is available promptly on request.

**MODEL
AB
DIALMATIC**



MAX.
CAPACITIES:
1 1/4" 3"
1 1/2" 4 1/4"
2 1/2" 5 3/4"

The most modern automatic available today. Equipped with Electronic Feed Drive. Turret tool feeds are infinitely adjustable, set by control panel dials. On 1 3/8" and 1 1/2" sizes, turret feeds and spindle speeds are electronically controlled. The 2 1/2" and 3" AB can be quickly converted to a chucker. Ease and rapidity of set-up, unlimited flexibility and maximum productivity for each tool are Dialmatic advantages.



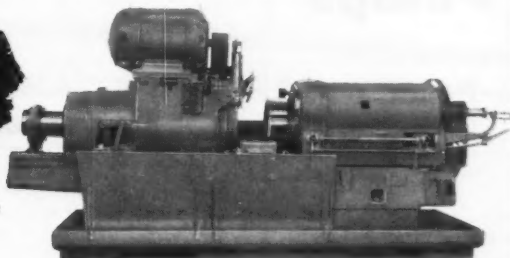
**MODEL
AW**

MAX.
CAPACITIES:
2 1/2"
4 1/4"
5 3/4"

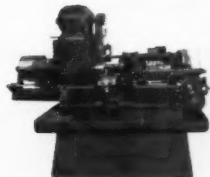
Differs from Model AB design only in that variable turret tool feeds are obtained through an improved mechanical drive. These are high-speed, accurate, rugged machines, quickly set up, easily operated. Their simplified mechanical design assures the user the utmost in freedom from downtime.

**MODEL
A**

MAX.
CAPACITIES:
1 1/4" 8"



More than seven hundred in use have proved Cleveland's time-tested *universal camming*. No special cams required to perform any work within the capacity of the machine.



**MODEL
B**

MAX.
CAPACITIES:
1 1/2" 2 1/2"

**MODEL
B-18**

MAX.
CAPACITIES:
1 1/2" 1 1/2" 2 1/2"

Model B's do not have tool turrets. Tooling is mounted on a milling slide capable of turning several OD in one operation, plus one end working operation, and on two cross slides where forming and additional turning can be performed. Ideal for work involving multiple diameters, shoulders, chamfers, tapers, etc. Model B-18" handles work up to 18" long. A 24" machine is also available.

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CLEVELAND

**Single Spindle Automatic
exactly right for your
turning and forming work**

The Cleveland Automatics briefly described at left combine an extremely wide range of multiple-tooled operations with quick set-up and simplified control. Four models in 16 capacities, make it possible for you to select a Cleveland *exactly suited* to your production requirements. Typical work performed by these Cleverlands is shown below.

**TYPICAL PARTS PRODUCED BY
MODEL AB, AW or A CLEVELANDS**



**TYPICAL PARTS PRODUCED
BY MODEL B CLEVELAND**



Whichever Cleveland you select, you'll obtain a modern machine tool that will give you fast, accurate, economical production on long or short runs. You'll also be taking advantage of 65 years of experience in precision engineering, plus Cleveland's matchless reputation for reliability and service.

Investigate the many advantages of Cleveland Automatics for your production. Call in a Cleveland sales engineer or let us submit recommendations with production and cost estimates based on part samples or prints of your work. There is no obligation.



For detailed descriptions of these Cleveland Automatics, write for new General Bulletin.

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Manufacturers of a Complete Line of Single Spindle Automatic Screw Machines and High Pressure Hydraulic Die Casting Machines

For more information fill in page number on Inquiry Card, on page 273

MACHINERY, November, 1956—393

SHAPERS, Crank and Hydraulic

Austin Industrial Corp., 76 Mamaroneck Ave., White Plains, N. Y.
 Cincinnati Shaper Co., Elam and Garrard Aves., Cincinnati, Ohio
 Nebel Mch. Tool Corp., 3401 Central Parkway, Cincinnati 25, Ohio
 Homstrand, Inc., Larchmont, N. Y.
 Rockford Mch. Tool Co., 2500 Kishwaukee St., Rockford, Ill.
 Sheldon Mch. Co., Inc., 4240-4258 N. Knox Ave., Chicago 41, Ill.
 South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
 Western Machine Tool Works, Holland, Mich.

SHAPERS, Vertical and Slotters

Austin Industrial Corp., 76 Mamaroneck Ave., White Plains, N. Y.
 Bridgeport Mch. Co., Inc., 500 Lindley St., Bridgeport 6, Conn.
 Consolidated Mch. Tool Div., Blossom Road, Rochester 10, N. Y.
 Homstrand, Inc., Larchmont, N. Y.
 Rockford Mch. Tool Co., 2500 Kishwaukee St., Rockford, Ill.

SHEARS, Alligator

Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio
 Lodge & Shipley Co., The, Cincinnati 25, Ohio

SHEARS, Rotary and Squaring

Birdsboro Steel Fdy. & Mch. Co., Birdsboro, Pa.
 Brown & Sharpe Mfg. Co., Providence, R. I.
 Cincinnati Shaper Co., Hopple & Garrard, Cincinnati 25, Ohio
 Johnson Mch. & Press Corp., 620 W. Indiana Ave., Elkhart, Ind.
 Lodge & Shipley Co., The, Cincinnati 25, Ohio
 Niagara Mch. & Tool Works, 683 Northland Ave., Buffalo, N. Y.
 Simonds Saw & Steel Co., (Knives), 470 Main St., Fitchburg, Mass.

SHEARS, Squaring

Cincinnati Shaper Co., Elam and Garrard Aves., Cincinnati, Ohio
 Lodge & Shipley Co., The, Cincinnati 25, Ohio
 Niagara Mch. & Tool Works, 683 Northland Ave., Buffalo, N. Y.
 Simonds Saw & Steel Co., (Blades), 470 Main St., Fitchburg, Mass.

SHEET METALS—See Strip and Sheet, Ferrous, Non-ferrous

SHIM STOCK

Laminated Shim Co., Inc., Glenbrook, Conn.
 Simonds Saw & Steel Co., 470 Main St., Fitchburg, Mass.

SHOP FURNITURE—See Furniture, Shop

SLITTING MACHINES, Rotary

Bliss Co., E. W., Canton, Ohio
 Niagara Mch. & Tool Works, 683 Northland Ave., Buffalo 11, N. Y.
 Yoder Co., 5504 Walworth Ave., Cleveland 2, Ohio

SLOTTERS—See Shapers, Vertical and Slotters

SOLENOIDS

Allen-Bradley Co., 1331 S. 1st St., Milwaukee 4, Wis.
 Barnes, John S. Corp., Rockford, Ill.
 General Electric Co., Schenectady, N. Y.
 National Acme Co., 170 E. 131st St., Cleveland 3, Ohio
 Vickers, Inc., Detroit 32, Mich.

SOCKETS—See Drill Sleeves and Extension Holders

SPECIAL MACHINERY AND TOOLS

Acromark Co., 9-11 Marrell St., Elizabeth, N. J.
 Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Cal.
 Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
 Baldwin-Lima-Hamilton Corp., Eddystone Div., Philadelphia 42, Pa.
 Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio
 Baker Bros., Inc., Sta. F., P.O. Box 101, Toledo 10, Ohio
 Bath, Cyril Co., Aurora & Solon Road, Solon, Ohio

(Continued on page 396)



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Rugged • Dependable
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139

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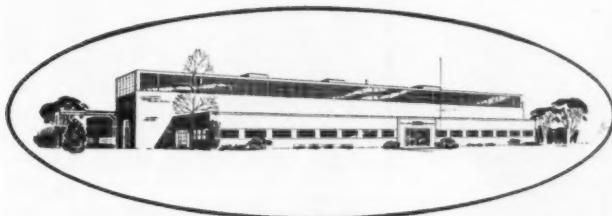
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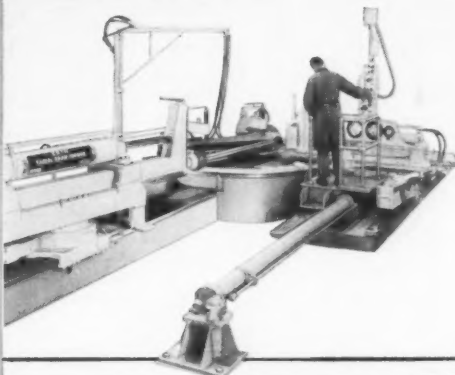


Send today for literature on Bath products or service. Catalogs on Stock Press Brake Dies, Power Press Brakes, Bath Press Type Brakes, Tangent Bending Sequence Presses, Aircraft Contract Forming or Stretch, Compression and Radial Draw Forming are yours for the asking. They contain a wealth of information on metal forming from simple blanking and bending to forming of complex parts.

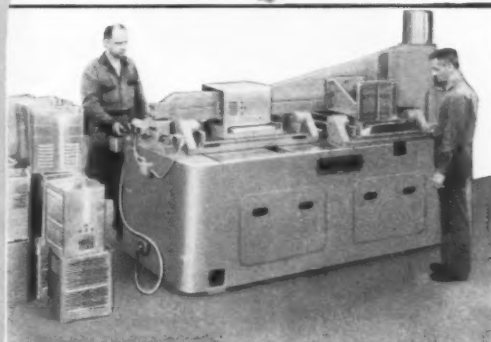
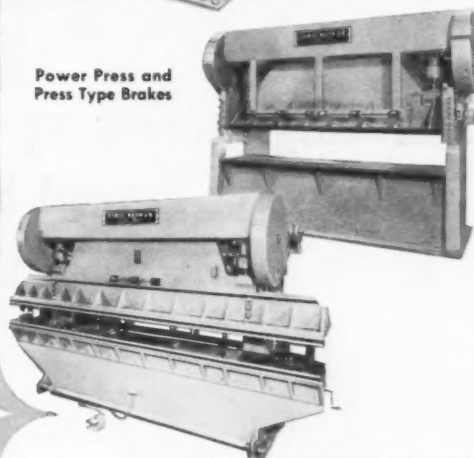


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Stretch, Compression or Radial Draw Forming Machines



Power Press and Press Type Brakes



Tangent Bending Sequence Presses



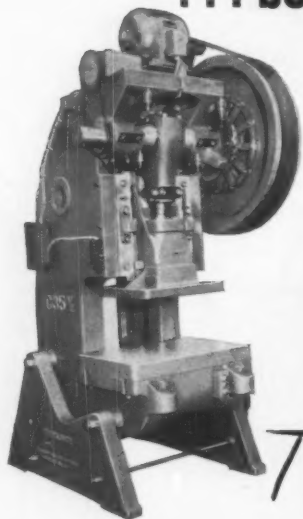
Stretch, Compression or Radial Draw Contract Formed Parts

Barnes Drill Co., 814 Chestnut, Rockford, Ill.
 Barnes, W. F. & John Co., 201 S. Water St.,
 Rockford, Ill.
 Baugh Machine Tool Co., 136 Wason Ave.,
 Springfield 7, Mass.
 Bethlehem Steel Co., Bethlehem, Pa.
 Bilgram Gear & Mch. Works 1217-35 Spring
 Garden St., Philadelphia, Pa.
 Birdsboro Steel Fdy. & Mch. Co., Birdsboro, Pa.
 Blanchard Mch. Co., 64 State St., Cambridge
 Mass.
 Bliss, E. W. Co., 1375 Raff Rd., S. W., Canton
 Ohio.
 Buhr Mch. Tool Co., 835 Green St., Ann Arbor
 Mich.

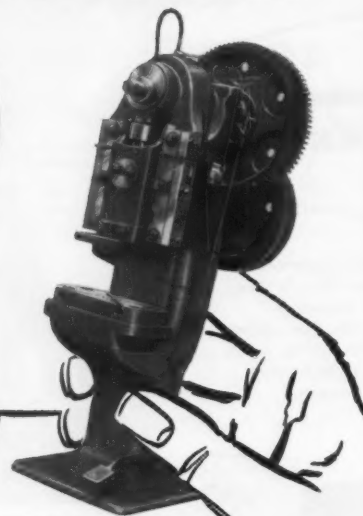
Chambersburg Engrg. Co., Chambersburg, Pa.
 Cincinnati Milling Mch. Co., Oakley, Cincin-
 nati 9, Ohio.
 Colonial Broach & Machine Co., P.O. Box 37,
 Harper Sta., Detroit 13, Mich.
 Columbus Die-Tool & Mch. Co., 955 Cleveland
 Ave., Columbus, Ohio.
 Consolidated Mch. Tool Corp., Rochester, N. C.
 Coulter, James, Machine Co., Bridgeport 5,
 Conn.
 Cross Co., Detroit, Mich.
 Erie Foundry Co., Erie, Pa.
 Espen-Lucas Mch. Works, Front St. and Girard
 Ave., Philadelphia, Pa.
 Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit
 32, Mich.

Farrel-Birmingham Co., Inc., 25 Main St., An-
 sonia, Conn.
 Federal Machine & Welder Co., Overland Ave.,
 Warren, Ohio.
 Fellows Gear Shaper Co., 78 River St., Spring-
 field, Vt.
 Gisholt Machine Co., 1245 E. Washington Ave.,
 Madison 10, Wis.
 Gorton, Geo., Mch. Co., 1110 W. 13th St.,
 Racine, Wis.
 Greenlee Bros. & Co., 12th and Columbia
 Aves, Rockford, Ill.
 Hannifin Corp., 501 S. Wolf Rd., Des Plaines,
 Ill.
 Hartford Special Mchry. Co., 287 Homestead
 St., Hartford, Conn.
 Hill Acme Co., 1201 W. 65th St., Cleveland 2,
 Ohio.
 Hydraulic Press Mfg. Co., Mount Gilead, Ohio
 Ingersoll Milling Mch. Co., 2442 Douglas St.,
 Rockford, Ill.
 Kingsbury Mch. Tool Corp., Keene, N. H.
 Lake Erie Engrg. Corp., Kenmore Station, Buf-
 falo, N. Y.
 Mercury Engrg. Corp., Milwaukee, Wis.
 Michigan Drill Head Co., Detroit 34, Mich.
 Michigan Tool Co., 7171 E. McNichols Rd.,
 Detroit 12, Mich.
 Millholland, W. K. Machinery Co., 6402 West-
 field Blvd., Indianapolis 5, Ind.
 Modern Industrial Engrg. Co., 14230 Birwood,
 Detroit 4, Mich.
 Moline Tool Co., 102 20th St., Moline, Ill.
 Morris Machine Tool Co., Inc., 946-M Harriet
 St., Cincinnati 3, Ohio.
 Motch & Merryweather Mchry. Co., Penton
 Bldg., Cleveland, Ohio.
 National Acme Co., 170 E. 131st St., Clevel-
 and, Ohio.
 National Automatic Tool Co., Inc., S 7th and
 N Sts., Richmond, Ind.
 National Broach & Mch. Co., 5600 St. Jean
 Ave., Detroit 2, Mich.
 National Twist Drill & Tool Co., Rochester,
 Mich.
 New Britain Mch. Co., New Britain-Gridley
 Mch. Div., New Britain, Conn.
 New Jersey Gear & Mfg. Co., 1470 Chestnut
 Ave., Hillside, N. J.
 Niagara Mch. & Tool Works, 683 Northland
 Ave., Buffalo, N. Y.
 Oilgear Co., 1569 W. Pierce St., Milwaukee,
 Wis.
 Rivett Lathe & Grinder, Inc., Brighton, Boston
 35, Mass.
 Seneca Falls Mch. Co., Seneca Falls, N. Y.
 Snyder Tool & Engrg. Co., 3400 E. Lafayette,
 Detroit 7, Mich.
 Standard Electrical Tool Co., 2488-90 River
 Rd., Cincinnati, Ohio.
 Sundstrand Mch. & Tool Co., 2531 11th St.,
 Rockford, Ill.
 Universal Engrg. Co., Frankenthuth 2, Mich.
 Verson Alsteel Press Co., 93rd St. & S. Ken-
 wood Ave., Chicago, Ill.
 Waltham Machine Works, Newton St., Wal-
 tham, Mass.
 Wicaco Machine Corp., Wayne Junction, Phila-
 delphia, Pa.
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 Boston Gear Works, 320 Main St., North
 Quincy 71, Mass.
 Brod Foote Gear Works, 1309 So. Cicero Ave.,
 Chicago 50, Ill.
 Cleveland Worm & Gear Co., 3249 E. 80th St.,
 Cleveland, Ohio.
 DoALL Co., Des Plaines, Ill.
 Farrel-Birmingham Co., Inc., 25 Main St., An-
 sonia, Conn.
 General Electric Co., Schenectady, N. Y.
 Harsburgh & Scott Co., 5114 Hamilton, Clevel-
 and, Ohio.
 Philadelphia Gear Works, Inc., Erie Ave., and
 G St., Philadelphia, Pa.
 Reliance Elec. & Engrg. Co., 1200 Ivanhoe Rd.,
 Cleveland 10, Ohio.

SPINDLES, Machine

Brown & Sharpe Mfg. Co., 235 Promenade St.,
 Providence 1, R. I.
 Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit
 32, Mich.
 Michigan Drill Head Co., Van Dyke, Mich.
 National Automatic Tool Co., S. 7th St.-N St.,
 Richmond, Ind.
 Pope Mchry. Corp., Haverhill, Mass.
 Standard Electrical Tool Co., 2488-90 River
 Road, Cincinnati, Ohio.
 Wadell Equip. Co., Clark, N. J.

(Continued on page 398)

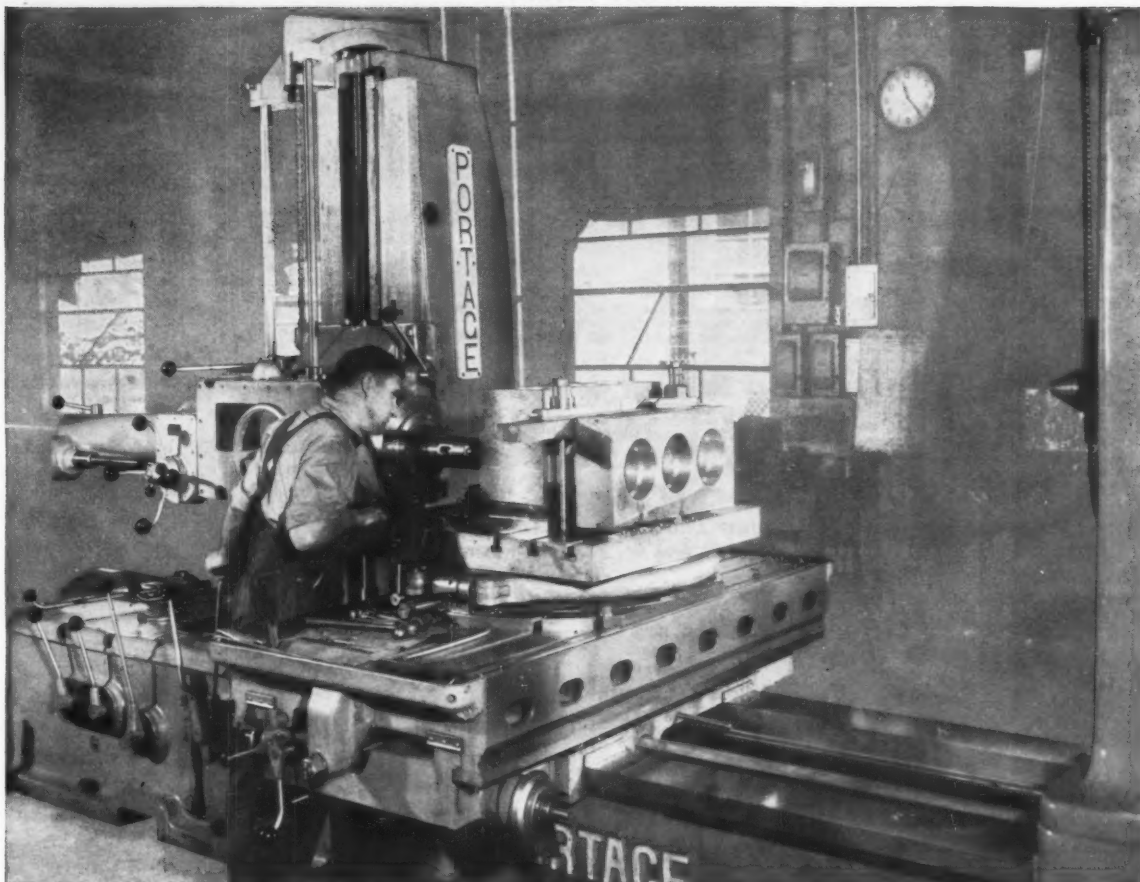


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The Portage Machine Co.
Akron, Ohio

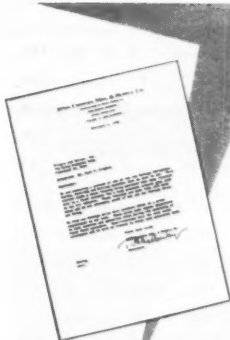
Gentlemen:

Our business, as you know, is Contractors of Metal Products. This particular job is a steel forging being machined, and when finished will be a fluid cylinder for a high pressure pump used in the oil industry. These forgings are made from AISI-4140 steel and we are extremely proud of the job PORTAGE mills are doing.

We find our PORTAGE mills very accurate. These mills must repeat themselves in each location and operation often during the machining operation. Specifications call for very close tolerances and we have no trouble in doing this precision work.

Yours truly,
20TH Century Mfg. & Supply Co.

R. G. Galloway
R. G. Galloway
President



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Representatives in Principal Cities

BUILDERS OF PRECISION MACHINE TOOLS, SPECIAL AND PRODUCTION MACHINERY SINCE 1916

For more information fill in page number on Inquiry Card, on page 275

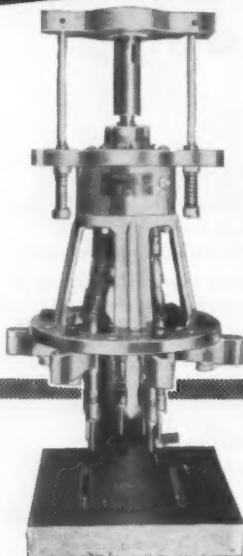
MACHINERY, November, 1956—397

SPRAYING EQUIPMENT, Metal

Metallizing Engrg. Co., Westbury, N. Y.

SPROCKETS—See Gears, Cut**STAMPINGS, Sheet Metal**Laminated Shim Co., Inc., Glenbrook, Conn.
Revere Copper & Brass Inc., 230 Park Ave.,
New York, N. Y.**STEEL, Cold Rolled, Stainless, High-Speed, Tool, Etc.**Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Carpenter Steel Co., 105 W. Barn St., Reading,
Pa.
Columbia Tool Steel Co., Chicago Hts., Ill.
Crucible Steel Co. of America, Oliver Bldg.,
Pittsburgh 30, Pa.
Cumberland Steel Co., 101 Williams St., Cum-
berland, Md.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th
St., Chicago 18, Ill.
Simonds Saw & Steel Co., 470 Main St., Fitch-
burg, Mass.
Timken Roller Bearing Co., Canton, Ohio
U. S. Steel Corp., (American Steel & Wire Co.),
Div., 436 7th Ave., Pittsburgh, Pa.
Vanadium-Alloys Steel Co., Latrobe, Pa.**STEEL DISTRIBUTORS**Ryerson, Jos. T., & Son, 16th & Rockwell St.,
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DoALL Co., Des Plaines, Ill.
Greenfield Tap & Die Corp., Greenfield, Mass.
Hill Acme Co., 1201 W. 65th St., Cleveland 2,
Ohio
Landis Mch. Co., Waynesboro, Pa.
Rivett Lathe & Grinder Inc., Brighton, Boston
35, Mass.
Threadwell Tap & Die Co., Greenfield, Mass.**STRAIGHTEDGES—See Machinists' Small Tools****STRAIGHTENERS, Flat Stock and Wire**Bliss Co., E. W., Canton, Ohio
Lewis Machine Co., 3441 E. 76th St., Cleveland
27, Ohio
Niagara Mch. & Tool Wks., 637-697 Northland
Ave., Buffalo 11, N. Y.
U. S. Tool Co., Inc., 255 North 18th St.,
Ampere, N. J.
Version Allsteel Press Co., 9309 S. Kenwood
Ave., Chicago 19, Ill.**STRIP AND SHEET, Ferrous**Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Carpenter Steel Co., 105 W. Barn St., Reading,
Pa.
Crucible Steel Co. of America, Oliver Bldg.,
Pittsburgh 30, Pa.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th
St., Chicago 18, Ill.
U. S. Steel Corp., (American Steel & Wire Co.
Div., Carnegie-Illinois Steel Corp., Div., Co-
lumbia Steel Co., Div., Tennessee Coal, Iron
& R. R. Co., Div.), 436 7th Ave., Pittsburgh,
Pa.**STRIP AND SHEET, Non-ferrous**American Brass Co., 25 Broadway, New York,
N. Y.
Bethlehem Steel Co., Bethlehem, Pa.
Bridgeport Brass Co., Bridgeport, Conn.
New Jersey Zinc Co., 160 Front St., New York
N. Y.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St.,
Chicago 18, Ill.**STRUCTURAL SHAPES**Bethlehem Steel Co., Bethlehem, Pa.
Revere Copper & Brass, Inc., 230 Park Ave.,
New York 17, N. Y.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St.,
Chicago 18, Ill.
U. S. Steel Corp., 525 Wm. Penn Pl., Pitts-
burgh 30, Pa.**STUD SETTERS—See Screwdrivers, etc.****SUPERFINISHING EQUIPMENT**Gisholt Machine Co., 1245 E. Washington Ave.,
Madison 10, Wis.**SURFACE PLATES**Brown & Sharpe Mfg. Co., 235 Promenade St.,
Providence 1, R. I.
Bryant Chucking Grinder Co., Springfield, Vt.
Challenge Mch. Co., Grand Haven, Mich.
Delta Power Tool Div., Rockwell Mfg. Co.,
Pittsburgh, Pa.
DoAll Co., Des Plaines, Ill.
South Bend Lathe Wks., South Bend 22, Ind.**SWITCHES, Limit**Allen-Bradley Co., 1331 So. 1st St., Milwaukee,
Wis.
Doelcam Div. of Minneapolis-Honeywell, 1400
Soldiers Field Rd., Boston 25, Mass.**TACHOMETERS—See Indicators, Speed****TAP HOLDERS**Brown & Sharpe Mfg. Co., 235 Promenade St.,
Providence 1, R. I.
Cleveland Automatic Mch. Co., 4932 Beech
St., Cincinnati 12, Ohio
Ettco Tool Co., Inc., 594 Johnson Ave., Brook-
lyn 37, N. Y.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit
32, Mich.
Michigan Drill Head Co., Van Dyke, Mich.
National Automatic Tool Co., S. 7th - N Sts.,
Richmond, Ind.
Scully-Jones & Co., 1903 Rockwell St., Chicago
8, Ill.**TAPPING HEADS**Baker Bros., Inc., Station F, P. O. Box 101,
Toledo 10, Ohio
Davis Boring Tool Div., Giddings & Lewis Mch.
Tool Co., Fond du Lac, Wis.
Errington Mechanical Laboratory, 24 Norwood
Ave., Stapleton, Staten Island, N. Y.
Ettco Tool Co., Inc., 592 Johnson Ave., Brook-
lyn, N. Y.
Homestrand, Inc., Larchmont, N. Y.
La Salle Tool, Inc., 3840 E. Outer Drive, Detroit
34, Mich.
Leland-Gifford Co., 1425 Southbridge St.,
Worcester, Mass.
Michigan Drill Head Co., 11449 Timken Ave.,
Van Dyke, Mich.
Millholland Mch. Co., W.K.M., Indianapolis
20, Ind.
National Automatic Tool Co., S. 7th - N Sts.,
Richmond, Ind.
Thrifmaster Products Corp., 1076 N. Plum
St., Lancaster, Pa.
Zagar Co., 24000 Lakeland Blvd., Cleveland
23, Ohio**TAPPING MACHINES**Baker Bros., Inc., Station F, P. O. Box 101,
Toledo 70, Ohio
Boush Machine Tool Co., 15 Wason Ave.,
Springfield 7, Mass.
Bodine Corp., 317 Mt. Grove St., Bridgeport,
Conn.
Cincinnati Bickford Div. Giddings & Lewis Mch.
Tool Co., Oakley, Cincinnati 9, Ohio
Chicago Pneumatic Tool Co., New York 17,
N. Y.
Cross Co., 3250 Bellevue Ave., Detroit 7, Mich.
Edlund Mchry. Co., 37 Huntington St., Cort-
land, N. Y.
Elox Corp. of Mich., 1830 Stephenson Highway,
Royal Oak 3, Mich.
Ettco Tool Co., Inc., 592 Johnson Ave., Brook-
lyn, N. Y.
Govro-Nelson Co., 1931 Antoinette St., De-
troit 8, Mich.
Hamilton Tool Co., 834 S. 9th St., Hamilton,
Ohio
Hill Acme Co., 1201 W. 65th St., Cleveland 2,
Ohio
Ingersoll-Rand Co., 11 Broadway, New York
4, N. Y.
Kaufman Manufacturing Co., Manitowoc, Wis.
Kingsbury Mch. Tool Corp., Keene, N. H.
Landis Mch. Co., Waynesboro, Pa.
La Salle Tool Inc., 3840 E. Outer Drive, Detroit
34, Mich.
Michigan Drill Head Co., Van Dyke, Mich.
Millholland, W. K. Machinery Co., 6402 West-
field Blvd., Indianapolis 5, Ind.
Moline Tool Co., 102 20th St., Moline, Ill.
Morris Machine Tool Co., Inc., 946-M Harriet
St., Cincinnati 3, Ohio
National Automatic Tool Co., Inc., S. 7th and
N Sts., Richmond, Ind.

(Continued on page 400)

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TAPPING & DRILLING HEAD**Here's another hi-speed pro-
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This dependable tool is ad-
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or 6 spindles. Positive clutch
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of the best grade sand Cast
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ground gears and spindles
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grooved ball thrust bearings
at all thrust points and Oilite
bronze radial bearings. Re-
member to do more... better
... faster... rely on Erring-
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Tools.#0-0" to 1/4" Tap Capacity
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Max. Pattern 8"**LESS THAN
1/2 MINUTE
TO CHANGE
HEAD FROM
DRILLING TO
TAPPING OR
DRILLING**

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**gives you A WIDE RANGE OF MOUNTINGS
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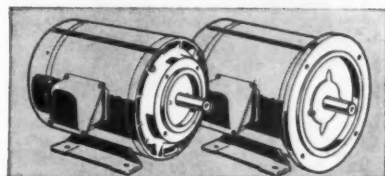
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For more information fill in page number on Inquiry Card, on page 275

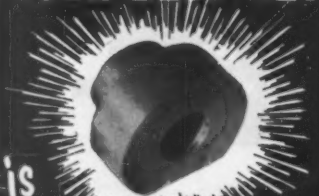


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MACHINERY, November, 1956—399

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CITY & STATE _____

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Western Machine Tool Works, Holland, Mich.
Zagar Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio

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Besly-Welles Corp., 112 Dearborn Ave., Beloit, Wis.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Greenfield Tap & Die Corp., Greenfield, Mass.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio
Threadwell Tap & Die Co., Greenfield, Mass.
Winter Bros. Co., Rochester, Mich.

TAPS, Collapsing

Greenfield Tap & Die Corp., Greenfield, Mass.
Landis Mch. Co., Waynesboro, Pa.
National Acme Co., 170 E. 131st St., Cleveland, Ohio
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio

THREAD CUTTING MACHINES

Coulter, James Machine Co., Bridgeport 5, Conn.
Davis & Thompson Co., 4460 W. 124th St., Milwaukee 10, Wis.
Eastern Mch. Screw Corp., New Haven, Conn.
Errington Mach. Lab. Inc., 24 Norwood Ave., Staten Island 4, N. Y.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio
Landis Mch. Co., Waynesboro, Pa.
Lees-Bradner Co., Cleveland, Ohio
Michigan Drill Head Co., Van Dyke, Mich.
Sheffield Corp., Dayton 1, Ohio

THREAD CUTTING TOOLS

Armstrong Bros. Tool Co., 5200 Armstrong Ave., Chicago, Ill.
Coulter, James, Machine Co., Bridgeport 5, Conn.
Eastern Mch. Screw Corp., New Haven, Conn.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio
Landis Mch. Co., Waynesboro, Pa.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio
Star Cutter Co., 34500 Grand River, Farmington, Mich.

THREAD ROLLING DIES—See Dies,
Thread Rolling

THREAD ROLLING EQUIPMENT

Landis Machine Co., Waynesboro, Pa.
National Acme Co., 170 E. 131st St., Cleveland 3, Ohio
Reed Rolled Thread Die Co., P. O. Box 350, Worcester 1, Mass.
Sheffield Corp., Dayton 1, Ohio

TOOL CONTROL BOARDS

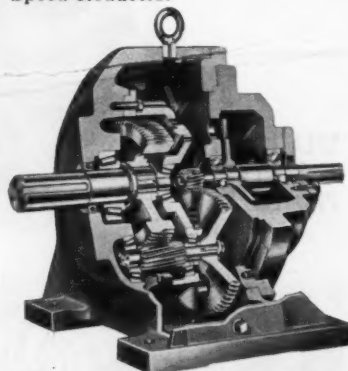
Cross Co., 3250 Bellevue, Detroit 7, Mich.
Royal Design & Mfg. Inc., 4133 E. 10 Mile Rd., Centerline, Mich.
Scully-Jones Co., 1906 S. Rockwell St., Chicago 8, Ill.

(Continued on page 402)

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Speed Reducers...FLEXIBLE...
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The streamlined compactness of these new units makes them ideal for mounting in places where space is limited. Accurately manufactured helical gearing, rugged housing construction and precision mounted shafts and bearings assure long, dependable service, with a minimum of maintenance. The new Phillie Gear "IN-LINE" Reducers are available in 18 different sizes and gear reductions to suit most types of service. Available for mounting in various positions... Standard AGMA ratios from 1.25:1 to 205:1.

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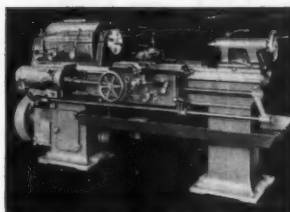
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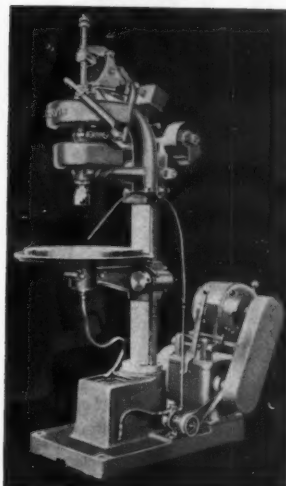
CHARD LATHES — Quick change, geared head; 16", 18" and 20" swing, 8 or 12 speeds.

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WESTERN RADIAL DRILLS—Heavy Duty, 3 to 8 ft., 16 or 32 speeds. High Speed, 3 to 6 ft., 6, 12 or 18 speeds.

GARVIN AUTOMATIC TAPPERS



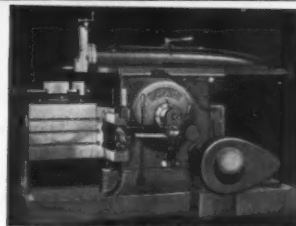
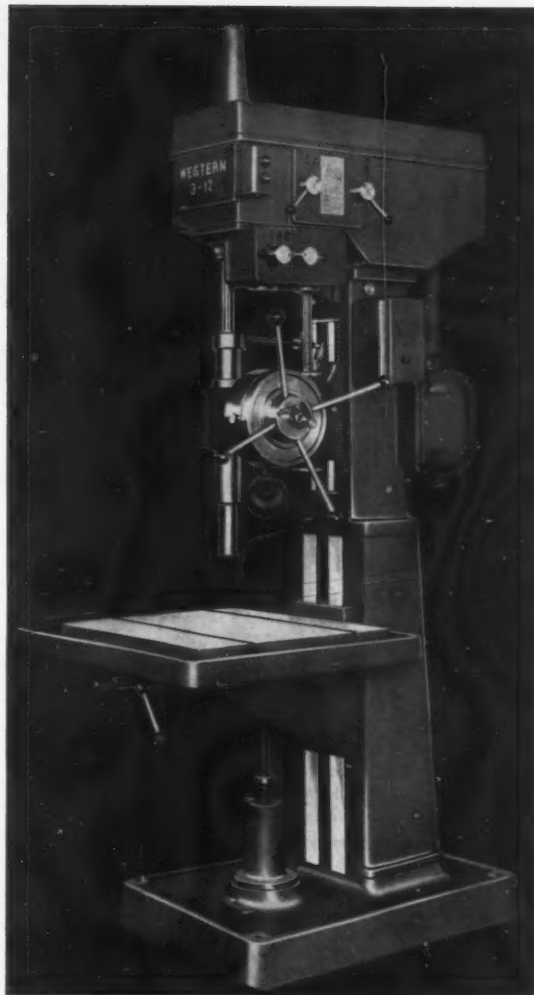
WESTERN HEAVY-DUTY UPRIGHT DRILLS contain 18 geared spindle speeds, nine power feeds, an extra large work table and ample power . . . all outstanding features built into this one machine. Available in single- or multiple-spindle models. All transmission shafts are multiple splined, precision ground, and have an alloy steel, involute splined spindle of heavy-duty proportions mounted on three precision ball bearings, with a No. 3 or No. 4 Morse taper nose. Speed and feed selections are made by sliding hardened steel gearing on multiple involute splined shafts. All transmission shafts are mounted on permanently lubricated ball bearings, eliminating supplementary lubrication. All of the gearing is totally enclosed and running in lubricant. Also available in high speed, infinitely variable type, single or multiple spindles. Complete accessory selection.

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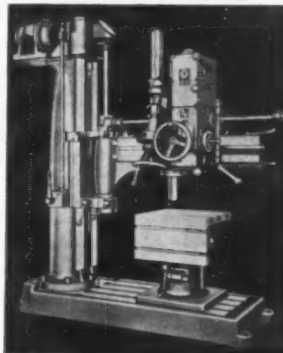
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Besly-Welles Corp., 112 Dearborn Ave., So.
Beloit, Ill.
Bridgeport Mch. Inc., 500 Lindley St.,
Bridgeport 6, Conn.
Brown & Sharpe Mfg. Co., 235 Promenade St.,
Providence 1, R. I.
Cleveland Automatic Mch. Co., 4932 Beech
St., Cincinnati 12, Ohio
Cleveland Twist Drill Co., 1242 E. 49th St.,
Cleveland 14, Ohio
Conforming Matrix Corp., Toledo, Ohio
Davis Boring Tool Div., Giddings & Lewis
Machine Tool Co., Fond du Lac, Wis.
Delta Power Tool Div., 400 N. Lexington Ave.,
Pittsburgh 8, Pa.
Eastern Mch. Screw Corp., Truman & Barclay
Sts., New Haven 6, Conn.
Eclipse Counterbore Co., 1600 Bonner Ave.,
Ferndale, Mich.
McCrosky Tool Corp., Meadville, Pa.
Metal Carbides Corp., 6001 Southern Blvd.,
Youngstown 12, Ohio
R & L Tools, 1825 Bristol St., Philadelphia
40, Pa.
Scully-Jones & Co., 1903 Rockwell St., Chi-
cago 8, Ill. (Turret)
Wesson Co., 1220 Woodward Heights Blvd.,
Ferndale, Mich.
Williams, J. H. & Co., 400 Vulcan St., Buffalo
7, N. Y.

TOOL MATERIAL, Cast Non-Ferrous Alloy

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Armstrong Bros. Tool Co., 5200 W. Armstrong
Ave., Chicago, Ill.
Haynes Stellite Co., 725 So. Lindsay St.,
Kokomo, Ind.

TOOL MATERIAL, Cemented Carbide

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Apex Tool & Cutter Co., Inc., 235 Canal St.,
Shelton, Conn.
Armstrong Bros. Tool Co., 5213 W. Armstrong
Ave., Chicago 30, Ill.
Besly-Welles Corp., 112 Dearborn Ave., Beloit,
Wis.
Cleveland Twist Drill Co., 1242 E. 49th St.,
Cleveland, Ohio
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Eclipse Counterbore Co., 1600 Bonner Ave.,
Ferndale, Mich.
Kennametal, Inc., Latrobe, Pa.
Metal Carbides Corp., Youngstown 12, Ohio
Spiral Step Tool Co., Chicago 25, Ill.
Star Cutter Co., 34500 Grand River, Farming-
ton, Mich.
Wesson Co., 1220 Woodward Heights Blvd.,
Ferndale, Mich.

TOOL MATERIAL, Ceramic

Metal Carbides Corp., Youngstown 12, Ohio
Norton Co., 1 New Bond St., Worcester 6,
Mass.

TOOL MATERIAL, High-Speed Steel

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Apex Tool & Cutter Co., Inc., 235 Canal St.,
Shelton, Conn.
Armstrong Bros. Tool Co., 5213 W. Armstrong
Ave., Chicago 30, Ill.
Carpenter Steel Co., Reading, Pa.
Cleveland Twist Drill Co., 1242 E. 49th St.,
Cleveland 14, Ohio
Crucible Steel Co. of America, Oliver Bldg.,
Pittsburgh 30, Pa.
du Mont Corp., 289 Wells St., Greenfield, Mass.
Eclipse Counterbore Co., 1600 Bonner Ave.,
Detroit 30, Mich.
Spiral Step Tool Co., 5400 N. Damen Ave.,
Chicago 25, Ill.
Star Cutter Co., 34500 Grand River, Farming-
ton, Mich.
Vanadium Alloys Steel Co., Latrobe, Pa.

(Continued on page 404)

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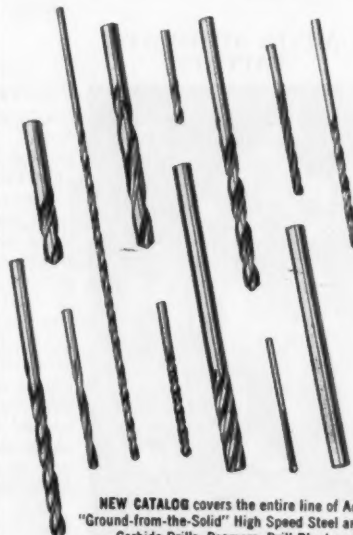


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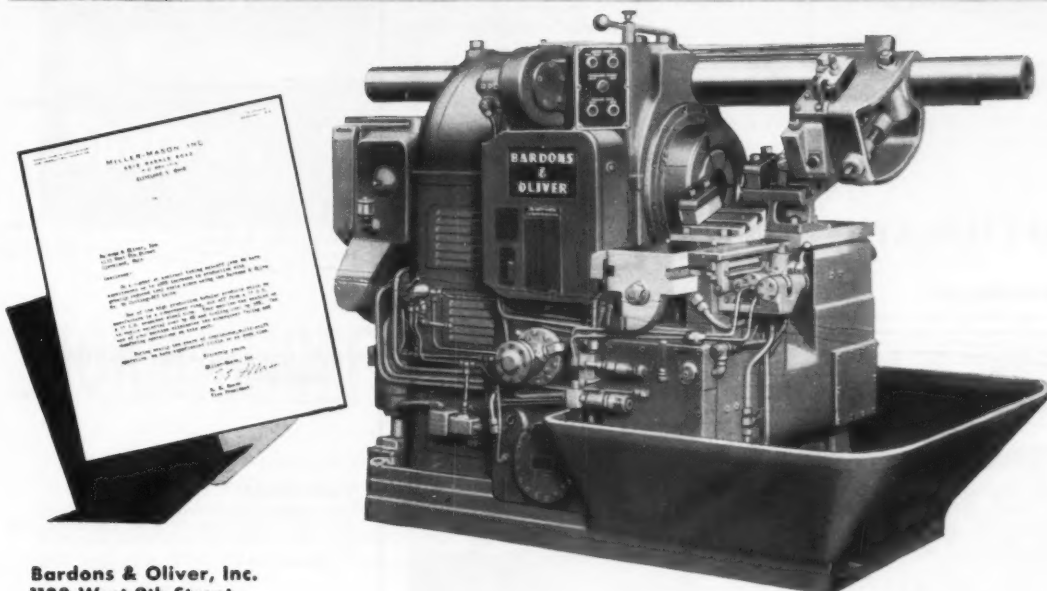
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HIGH SPEED BAND SAWS

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Gorton Mch. Co., 1321 Racine St., Racine, Wis.
Jones & Lamson Mch. Co., 512 Clinton St.,
Springfield, Vt.
Sidney Mch. Tool Co., Sidney, Ohio
Wales-Strippit Co., N. Tonawanda, N. Y.
Warner & Swasey, 5701 Carnegie Ave., Cleveland 3, Ohio

TRANSFER MACHINES, Automatic— See Multiple-Station Machines

TRANSMISSION, Variable Speed

Barnes, John S. Corp., Rockford, Ill.
Boston Gear Wks., Quincy, Mass.
Cleveland Worm & Gear Co., 3249 E. 80th St.,
Cleveland 4, Ohio
Oilgear Co., 1569 W. Pierce St., Milwaukee,
Wis.
Reliance Electric & Engrg. Co., 1047 Ivanhoe
Rd., Cleveland 10, Ohio
Vickers, Inc., Detroit 32, Mich.

TRUCKS, Material Handling

Hamilton Tool Co., 834 So. 9th St., Hamilton,
Ohio

TUBE-FLANGING MACHINES

Grant Mfg. & Mch. Co., 90 Silliman Ave.,
Bridgeport 5, Conn.
Niagara Mch. & Tool Wks., 637-697 Northland
Ave., Buffalo 11, N. Y.

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Yoder Co., 550 Walworth Ave., Cleveland, Ohio

TUBE MILLS

Etna Machine Co., Perrysburg, Ohio
Yoder Co., 550 Walworth Ave., Cleveland, Ohio

TUBING, Non-ferrous

American Brass Co., 25 Broadway, New York,
N. Y.
Bridgeport Brass Co., Bridgeport, Conn.
Mueller Brass Co., Port Huron 34, Mich.
Revere Copper & Brass Inc., 230 Park Ave.,
New York, N. Y.
Ryerson & Son, Inc., Jos. T., 2558 W. 16th St.,
Chicago 18, Ill.

TUBING, Steel

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Carpenter Steel Co., Reading, Pa.
Crucible Steel Co. of America, Henry W.
Oliver Bldg., Mellon Square, Pittsburgh 22,
Pa.
National Tube Div., U. S. Steel Corp., 525 Wm.
Penn Place, Pittsburgh, Pa.
Revere Copper & Brass, Inc., 230 Park Ave.,
New York 17, N. Y.
Ryerson, Jos. T. & Son, 2558 W. 16th St.,
Chicago 18, Ill.
Timken Roller Bearing Co., Canton, Ohio

ULTRASONIC MCH. TOOLS

Sheffield Corp., Dayton 1, Ohio
(Continued on page 406)

**For Greater
Load Carrying
Capacity
in Minimum
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If your bearings must operate under such severe conditions as high speeds, heavy loads, temporary overloads, shock or vibration, then *Norma-Hoffmann Precision Roller Bearings* are your solution. Available in a wide range of both metric and inch sizes from 10 millimeter bore upward.

Compare These Advantages

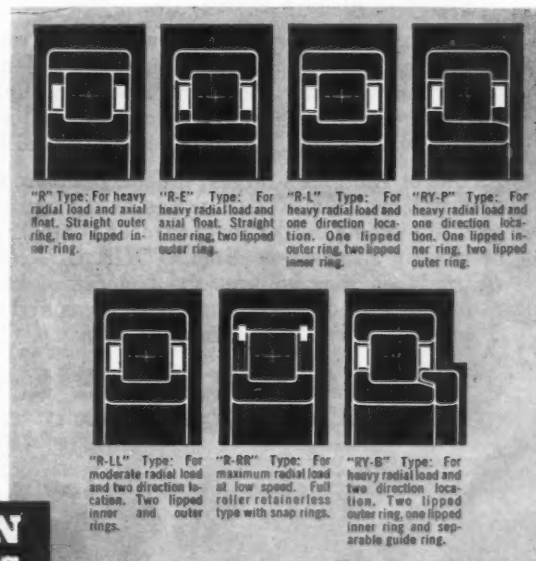
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Numatics, Inc., Milford, Mich.
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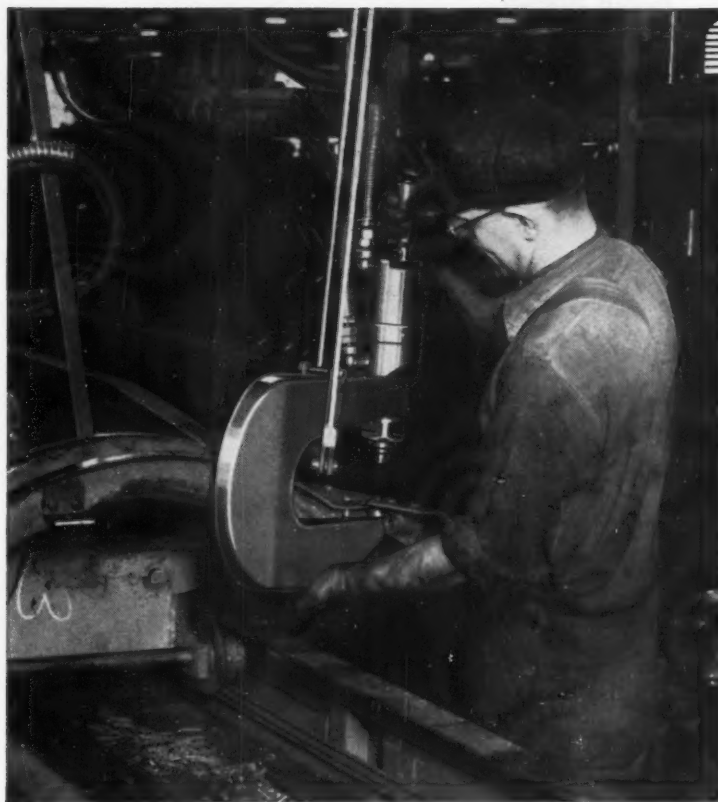
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(Continued on page 408)



ACTION PICTURE **of how to save money** **by riveting!**

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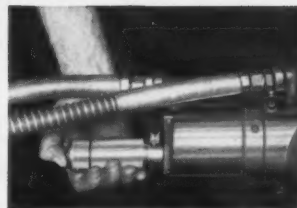
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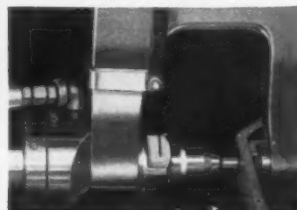
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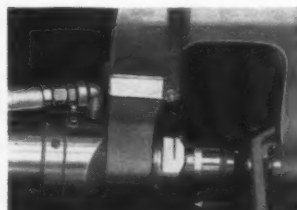
here's the **HANNIFIN** **"HY-POWER"** **WORK CYCLE**



In position. A single control button starts (or interrupts) the automatic Hy-Power cycle.



Ram approaches fast, then hydraulic pressure automatically intensifies, and the rivet head is formed.



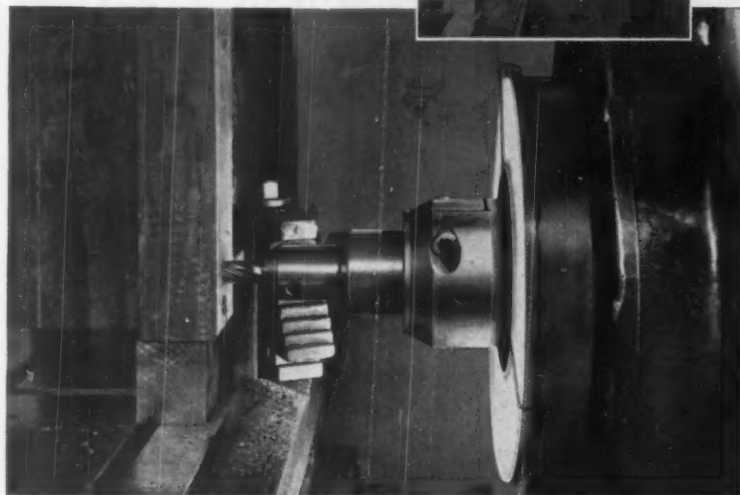
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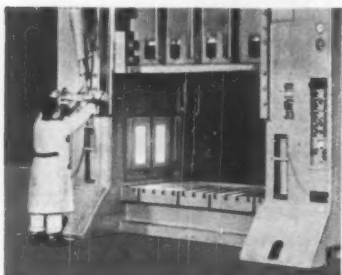


See the difference "Sun-Lite" makes on this typical boring mill set-up! At right, under normal shop lighting conditions, tool and work are poorly defined, hard to see. Below, with Sun-Lite "Circline" Unit mounted over the spindle, the entire working area is bathed in soft, glare-free light.



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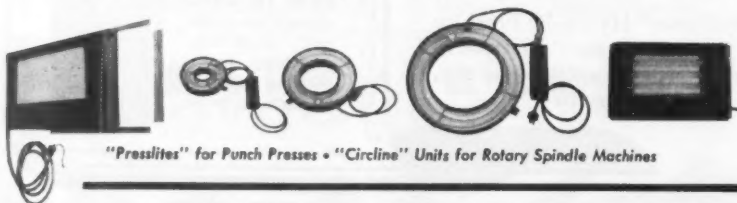
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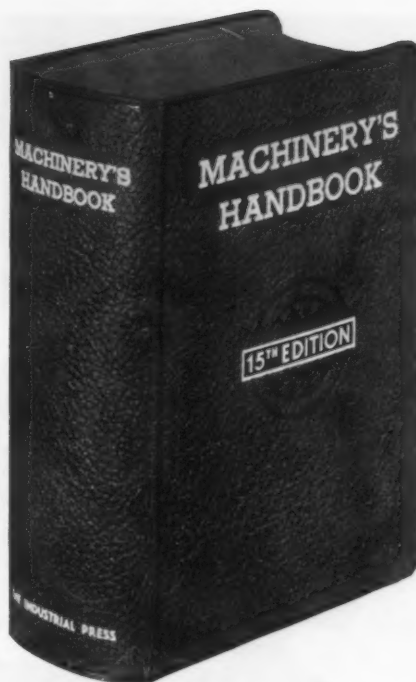
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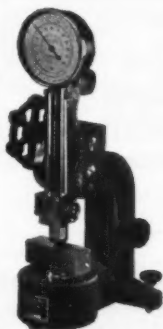
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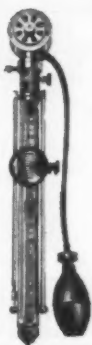
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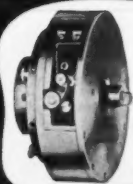
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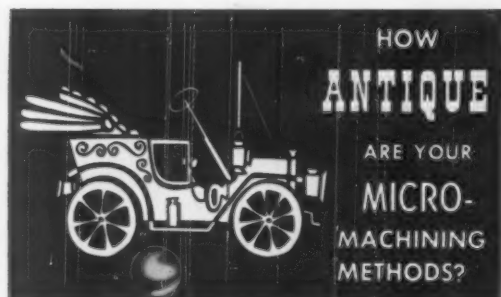
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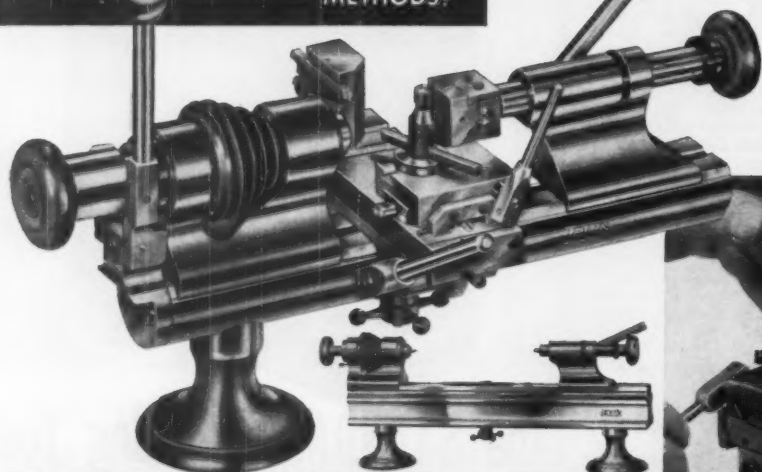
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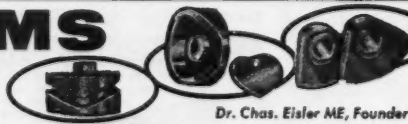
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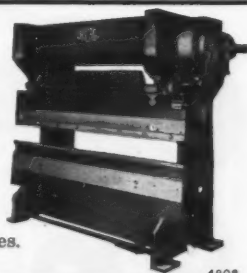
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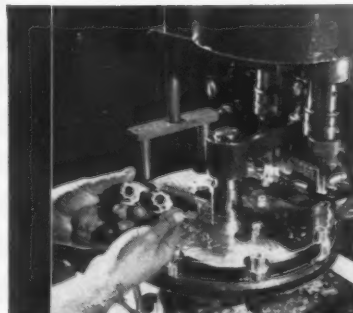
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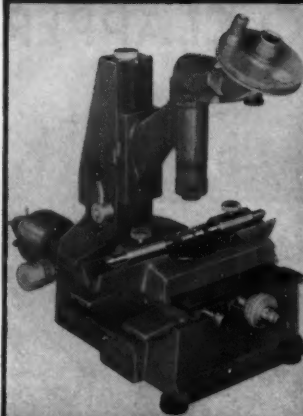
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No. 33 Excel Precision, m.d.
INTERNAL GRINDERS
No. 5 Bryant, m.d. latest
Model 5Y Bryant, m.d.
No. 16-16" Bryant, m.d., hydraulic Hole Grinder
No. 16C10 Bryant, m.d., latest
No. 16-22" Bryant, m.d., latest
No. 16-38" Bryant, m.d., latest
No. 16-A-28" Bryant, m.d.
No. 24-38 Bryant Hole & Face Type, m.d., late
No. 24P-38" Bryant, m.d.
No. 24-31" Bryant, m.d.
No. 24-L-38 Bryant, m.d., late
No. 24-LW-38 Bryant, m.d., late
No. 44 Head Facing Type Borematic, m.d.
No. 47A Head Borematic, m.d.
No. 449-16" Van Norman Automatic Oscillating Radius, m.d., latest
No. 70A Head, m.d., latest
No. 72 Head Sismatic, m.d.
No. 72A Head Sismatic, "Duplex", m.d.
No. 72A Head Gagematic, m.d.
No. 72AS Head Gagematic, m.d.
No. 72AS Head Sismatic, m.d.
No. 72AS Head Sismatic, m.d.
No. 73 Head Plain, m.d.
No. 73 Head Airplane, m.d., latest, new
No. 74 Head, m.d.
No. 74 Head, Plain Long Base, m.d., 1941
No. 75A Head, m.d., latest
No. 78 Head Centric Cylinder Grinder, m.d.
No. 81 Head Gagematic, Sismatic, m.d.
No. 81 Head Plain & Sismatic, m.d.

PUNCHES & SHEARS
No. 2 Hiles & Jones Horizontal Punch, m.d.
No. 7 Thomas Vertical, latest
No. 6 1/2 Hiles & Jones Punch & Shear, single end, type "G"
Cleveland Shear, 73" gap, 18" blade, 1" plate
Cleveland Type G Vertical Punch, 72" throat, m.d.
Wiedemann K7 Turret Punch

SNAG GRINDERS
Type No. 50-7 1/2 H.P. Standard Elec. Tool Co. Double End, m.d.
25 H.P. U.S. Elec. Tool Co. Heavy Duty Double End, m.d.

TOOL & CUTTER GRINDERS
Gisholt Universal Tool Grinder, belt
Type OSD Sellers Drill Grinder, m.d.
Type O-3GP Sellers Drill Point Thinning Machine, m.d.
Grand Rapids Tap Grinder, style 12M
No. 2A Wm. Sellers Universal Tool Grinder, m.d.
No. 2B Sellers Wet Grinder, m.d.
No. 2 Lemson Oscillating Tool Grinder, belted m.d.
No. 4T Sellers Tool, m.d., latest
No. 5T Sellers, m.d.
No. 13 Gleason Cutter Sharpener, m.d., late
Ingersoll Pace Mill Grinder
No. 13 Brown & Sharpe Universal Cutter Grinder, m.d.
12" Gleason Spiral Bevel Gear Cutter Sharpener, m.d.

PRESSES
100 ton Wood Hydraulic Press, four col., single action
100 ton Chambersburg Hydraulic
No. 62 E. W. Bliss Duplex Press, m.d.
Chambersburg 30 ton Hydro-Pneumatic, 13" stroke
No. 6 Verdin, Kappes & Verdin Straight Side Press
No. 4 Stereoon G.B.L. Punch Press, direct geared flywheel drive
Type S570 Hennlin Hydraulic Straightening Press

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No. 3 Motch & Merryweather, 1944
No. 32B Cochran Bly Saw, m.d., latest
11x11" Peerless Hydra-Cut Power Hack Saw, m.d.

ENGINE LATHES
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12"x40" centers 6' bed American, m.d.
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13"x48" centers Pratt & Whitney Geared Head, m.d.
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14"x26" Lodge & Shipley Geared Head, m.d.
14"x26" Pratt & Whitney, cone
14"x26" LeBlond, cone
14"x26" LeBlond, Geared Head, a.p.d.
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14"x26" Sidney Geared Head, m.d.
14"x26" Springfield Geared Head, m.d., taper
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16"x30" centers Monarch, m.d., taper
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16"x26" Hendey Geared Head, m.d.
16"x26" Hendey Yoke Head, m.d., taper
16"x26" Lehmann Geared Head, m.d.
16"x26" Lodge & Shipley Selective Head, m.d.
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17"x26" LeBlond Geared Head, m.d.
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18"x26" American, 8 speed, m.d.
18"x26" LeBlond Geared Head, m.d.
18"x26" Greaves-Klusman Geared Head, m.d.
18"x26" bed American Geared Head, m.d.
18"x26" Hendey Geared Head, m.d., taper
18"x26" Lodge & Shipley Geared Head, m.d.
18"x26" Whitcomb-Blaisdell Geared Head, m.d.
18"x10" bed Boys & Emmes, cone, motorized
19"x26" bed LeBlond Geared Head, Timken, m.d.
19"x10" bed LeBlond Geared Head, m.d.
20"x12" centers 10' bed Cincinnati Loose Change, cone
20"x12" centers Monarch Geared Head, m.d.
20"x10" centers American, m.d.
20"x26" bed Lodge & Shipley Geared Head, m.d.
20"x26" bed Greaves-Klusman Geared Head, m.d. in leg
20"x26" bed Boys & Emmes, m.d.
20"x26" bed Claco, cone, motorized
20"x10" Sidney Geared Head, m.d.
20"x10" 6" Boys & Emmes, cone, motorized
21"x26" bed LeBlond Geared Head, m.d., taper
23"x26" centers LeBlond Heavy Duty Geared Head, m.d.
24"x12" bed American, m.d.
24"x12" bed LeBlond Geared Head, m.d., taper
24"x12" bed Boys & Emmes, belt drive
24" raised to swing 32"x22" bed—16' centers—New Haven, cone, taper
24" 51-1/4" Lodge & Shipley Lathe, m.d.
25"x10" bed LeBlond Geared Head, m.d., taper
25"x10" centers LeBlond Heavy Duty G.H., m.d.
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GRINDERS, CYLINDRICAL, 10" x 18" Norton semi-automatic, plunge cut, new 1943.
GRINDERS, SURFACE, 13" x 60" Model 300 Hanschett vertical spindle, new about 1946.
AUTOMATIC, 1 1/4"-6" spdl No. 61 New Brittain checker, serial 25230
GRINDERS, SURFACE, 72" No. 72 Hanschett rotary, new 1946.
SURFACE GRINDER, No. 1 1/4" Abrasive, serial 786, late.
MILL, No. 2 Cincinnati plain horizontal, serial 4A2PIK17, late.
HAMMER, Chambersburg No. 3C pneumatic, late
LATHES, TURRET, No. 5 Gisholt ram type universal, new 1940
MILL, No. 34-36 Cincinnati duplex mill, serial 3B33DIN-4, late.
GRINDER, 4" x 12" Model 4H Landis plain cylindrical, new 1943.
LATHES, ENGINE, 14" x 6' bed Hendey toolroom, Timken, 1940.
LATHES, MFG., Model 10 Sandstrand automatic, front & rear slides, new 1942.
LATHES, TURRET, No. 3 Gisholt universal (2) late.
LATHES, TURRET, 36" and 42" Ballard New Era vertical.
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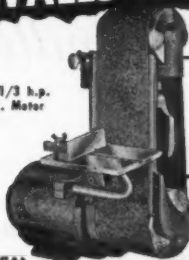
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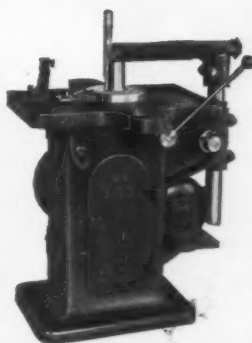
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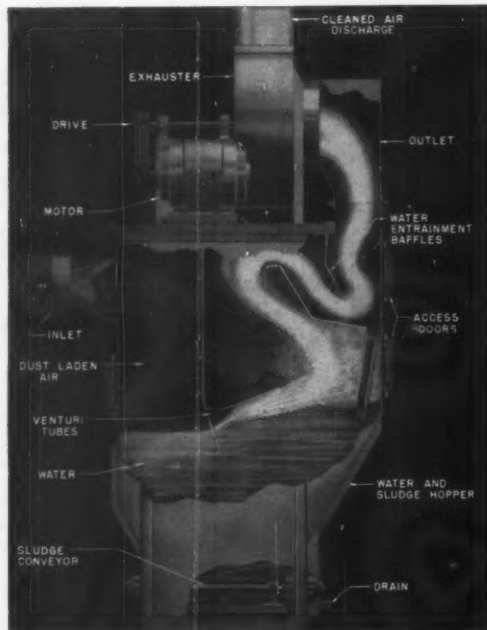
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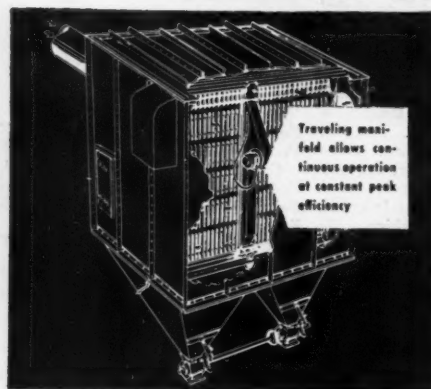
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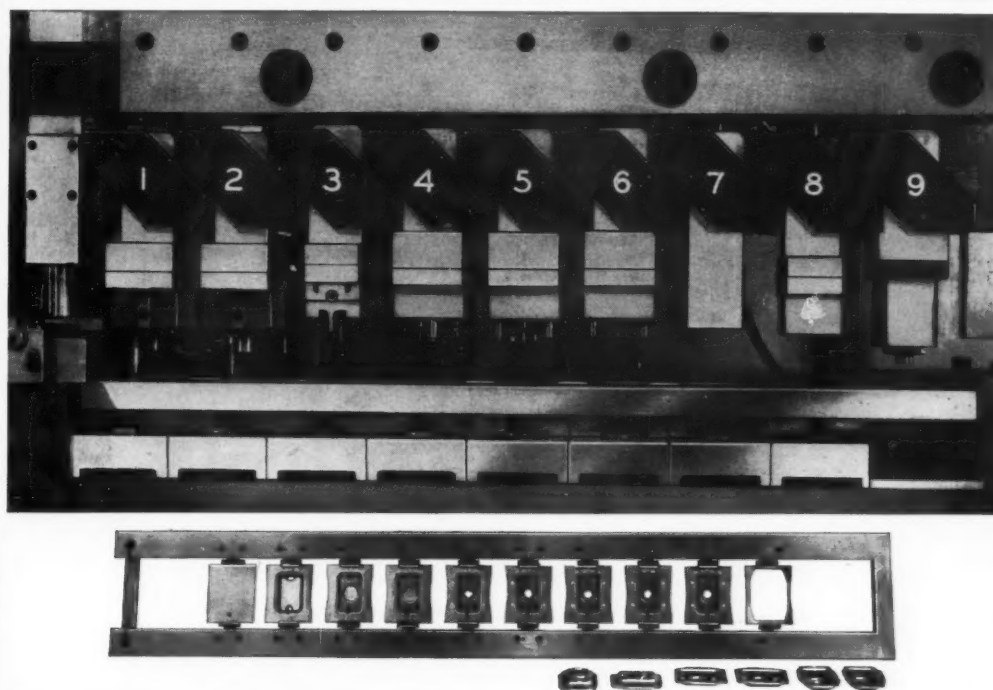
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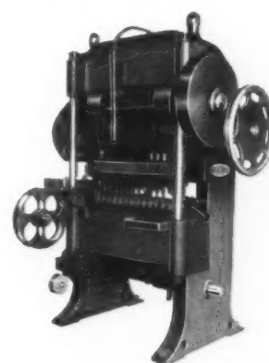
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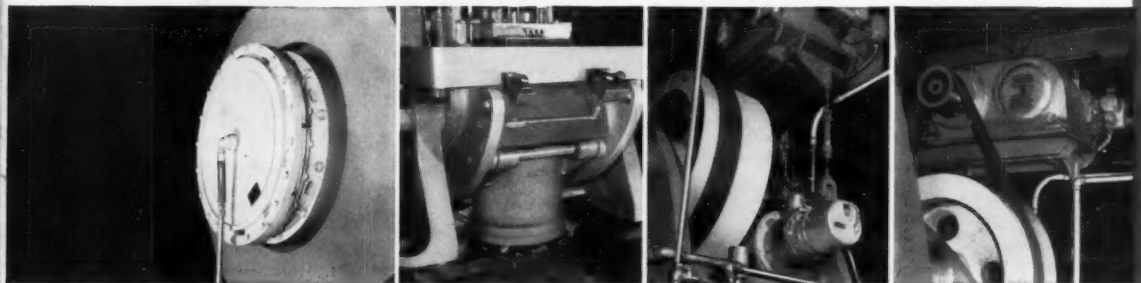
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